The Role of Emotion in Confabulation and Amnesia

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Abstract

The present programme of studies investigated whether there is a positive emotional bias in the content of confabulation using the semantic-associates paradigm. This procedure comprises lists of semantically related items that are associated with a non-presented critical distracter.

In three studies, 26 confabulating amnesia patients, 26 non-confabulating amnesia patients and 26 healthy controls were presented with the semantic-associates task. In study 1, this procedure was employed to induce false recall and false recognition in response to studying lists of positive, negative and neutral word lists. In study 2, a facial expressions semantic-associates procedure was constructed to examine false recognition of pictorial items. In the final study, participants were induced into positive and negative mood using a video mood induction procedure to examine the effects of mood on false recall and false recognition.

Confabulating patients showed a positive emotional bias and falsely recognised a higher proportion of positive unrelated intrusions compared with non-confabulating patients and healthy controls. These findings suggested that confabulating patients' tendency to produce pleasant false memories may represent a bias in general emotional processing.

However, the positive bias was not found in the facial expressions task. This suggested that the distinctive characteristics in pictorial items may aid confabulating patients in the discrimination between studied items and non-studied intrusions. In addition, reduced false recognition of critical distracters in

both confabulating and non-confabulating patients was a marker for gist memory impairment in amnesia.

Finally, the video mood induction procedure demonstrated that the positive bias in confabulating patients was enhanced by, but not specific, to negative mood. However, findings from a signal detection analysis indicated that confabulating patients showed a positive bias because their memory strength for positive material was significantly weaker compared with that of non-confabulating patients and healthy controls. Future studies would need to equate for differences in memory strength between controls and amnesia patients in order to provide stronger evidence that emotional factors are playing a role in the content of confabulation.

CHAPTER ONE

1.1. Introduction to Confabulation

This review of the literature will begin by discussing the definition, classification and characteristics of confabulation. This will then relate to brain pathology and neuropsychological theories about the nature of the deficit in confabulation. In the later part of this review, recent work on the semantic-associates procedure will be considered as a measure of prompting false recall and false recognition in memory. The scant evidence that has been collected in these tasks in confabulation will also be considered in order to set out the goal of the present programme of studies.

1.1.1. Definition

Confabulation refers to false memories observed in the context of a neurological disorder (Korsakoff, 1889; Johnson et al., 2000). These memories may be entirely false or, in some cases, only partially incorrect (for example, the memory is correct but the time, place or temporal context is distorted) (Berlyne, 1972; Kopelman, 1987). The current consensus is that confabulation is not intentional because confabulating patients are typically unaware of the inaccuracy of their memory output (Nadel & Moscovitch, 1997; Berrios, 2000).

1.1.2. Classification

Confabulation is commonly considered as a syndrome because of its varying manifestations (Schnider, 2003; Kopelman, 2010; Gilboa and Moscovitch, 2002). Several classifications have been suggested in order to organise these varieties into meaningful groups. Early classifications categorised confabulation into two types called ‘momentary’ and ‘fantastic’ confabulations. Momentary confabulations are real memories that are retrieved out of context whereas fantastic confabulations are bizarre and convey little or no relation to reality (Berlyne, 1972).

An alternative, but overlapping, classification contrasts between ‘spontaneous’ and ‘provoked’ confabulations. Spontaneous confabulations are persistent and florid erroneous memories that arise without any provocation. In contrast, provoked confabulations arise in response to questions or tasks that test the patient’s memory (Kopelman, 1999).

In a recent classification, Schnider (2008) organised the different varieties of confabulation into four meaningful types. Intrusion or simple provoked confabulations appear during memory tests whereas momentary confabulations are false statements that appear during conversations or questions. Fantastic confabulations are imaginative and sometimes implausible. Finally, spontaneous confabulations are grandiose and bizarre false memories that are persistent and occur without prompting the patient. Schnider (2003) argued that spontaneous confabulations compel the patient to act on their distorted beliefs. Schnider explained that this characteristic distinguishes spontaneous confabulations from provoked confabulations, which appear in response to memory tests.

Furthermore, Schnider and colleagues (2003) obtained findings that supported the distinction between spontaneous and provoked confabulations. They showed that spontaneous confabulations were typically observed after lesions to the ventromedial prefrontal cortex and contiguous areas including the basal forebrain and anterior limbic structures. In contrast, provoked confabulations were found in a variety of brain lesions and sometimes occurred in healthy individuals.

Conversely, subsequent findings have shown that some patients produce both spontaneous and provoked confabulations concurrently. This led Gilboa and colleagues (2006) to question whether there is a genuine distinction between these two types of confabulations (Gilboa et al., 2006; Zannino et al., 2008).

1.1.3. Characteristics

Talland (1965) examined the clinical characteristics of confabulation in patients with alcohol-induced disproportionate memory impairment, a condition known as Korsakoff syndrome. One of these characteristics is that confabulating patients are unaware of their memory distortions, a condition known as anosognosia. Talland also reported that these patients sometimes acted on their confabulations. These patients believed their confabulations to be genuine accounts of their lives rather than imagined constructs.

According to Talland, confabulations are typically self-referential experiences and relate to the patient. However, the validity of this characteristic was questioned when clinical findings showed that patients produced confabulations on personally-unrelated tasks (Kopelman, 1987; Wyke and Warrington, 1960). Subsequently, Moscovitch (1989) reformulated Talland's characteristics to state that confabulations are more apparent in autobiographical recollection. This reformulation recognises that the mechanisms impaired in confabulating patients are more strained when the patient is asked to recount autobiographical episodes, but that confabulations can also occur in other types of memory (Dalla Barba, 1997; Burgess and Shallice, 1996). Dalla Barba (1993) found that patients produced most confabulatory responses to questions relating to episodic memory. These findings were consistent with subsequent results by Kopelman and colleagues (1997) showing that patients produced eight confabulatory statements on fifteen episodic questions.

Although confabulating patients are unaware of the inaccuracy of their memory output, they can identify deterioration in their memory performance (for example, difficulty in remembering people's names). Confabulation is associated with amnesia and often with acute confusion. Schnider and colleagues (2000) argued that patients stop confabulating over the course of time as they recover from temporal confusions in memory.

1.1.4. Diagnosis

Confabulations and delusions are syndromes that involve distorted beliefs about reality. This similarity caused intense controversy and produced two contrasting perspectives on the differential diagnosis of confabulations and delusions. One view is that there is a distinction between confabulations and delusions, and treats them as separate. According to this view confabulations are false memories observed in the context of a neurological disorder, whereas delusions are false beliefs observed in the context of a psychiatric illness (Mullen, 1986; Kopelman, 1999).

Kopelman (2010) argued that delusions take many forms and can be observed in a variety of psychiatric disorders. For example, delusions of control (involving actions and emotions) and delusions of thought (concerning thought insertion or mind control) are first-rank symptoms of schizophrenia. On the other hand, delusions of worthlessness and self-accusation are sometimes found in depression. In contrast to confabulations, delusions do not always have a memory component. Some of the most commonly observed delusions are unrelated to memory. For example, the belief that thoughts are being controlled by an external force may be the result of abnormal biases in perception and attention.

Coltheart and Turner (2010) put forward an opposing perspective. They noted that in both delusions and spontaneous confabulations there is a failure to disregard implausible thoughts. They argued that false memories that are produced without any provocation are examples of false beliefs and should be referred to as delusions rather than as spontaneous confabulations. Coltheart and Turner (2009) proposed that the neurological memory syndrome constitutes of only provoked confabulations. In contrast, Schnider and colleagues (2008) emphasised that spontaneous confabulations are genuine because they are often identified in the clinical population and more specifically, in autobiographical memory.

1.1.5. Aetiology

Confabulation has often been observed in patients with Korsakoff syndrome (Mercer et al., 1977; Dalla Barba et al., 1990). This symptom has also been found in a variety of other pathologies, all of which involve memory impairment:

traumatic brain injury, dementia, encephalitis and subarachnoid haemorrhage (Dalla Barba, 1993, Nedjam et al., 2004; Mercer et al., 1977; Schnider et al., 2005). However, confabulations not only occur in the context of a memory deficit, but have also been associated with damage to the ventromedial prefrontal cortex (Schnider, 2008; Gilboa et al., 2006).

The anatomical basis of confabulation has been typically studied using neuroanatomical lesion data. Gilboa and Moscovitch (2002) reviewed 39 studies and assessed 79 confabulating patients. They found that the prefrontal lobes were damaged in 81% of these patients. In particular, lesions to the ventromedial and orbitofrontal aspects were common in these patients.

Subsequently, Gilboa and colleagues (2006) conducted a study on twelve patients diagnosed with ruptures of an Anterior Communicating Artery (ACoA) aneurysm (Gilboa et al., 2006). Four of the ACoA patients displayed evidence of a confabulatory syndrome. All patients were asked to recount four different stories from beginning to end. Findings showed that the confabulating ACoA patients tended to produce idiosyncratic details in the stories compared with non-confabulating ACoA patients. Gilboa and colleagues conducted a lesion analysis and found that the confabulating ACoA patients showed lesions in the ventromedial and orbitofrontal prefrontal surfaces of the frontal lobes (Gilboa et al., 2006). This finding was similar to Toosy and colleagues (2008) neuroimaging results. Toosy and colleagues conducted brain scans on a patient diagnosed with an autoimmune disease called Morvan's syndrome. Neuropsychological assessments indicated that this patient exhibited pronounced confabulatory symptoms and severe memory difficulties. The imaging data on this patient showed abnormalities in the left medial temporal lobes but more particularly in the orbitofrontal regions of the brain. This finding coincides with the conventional view that the ventromedial and orbitofrontal cortex are damaged in confabulation (Schnider, 2008).

Turner and colleagues (2008) investigated the prevalence and localisation of confabulation in 38 patients with frontal lesions. These patients were compared with 12 patients with posterior lesions and 50 healthy controls. The occurrence of confabulation was measured using a confabulation battery that included questions that probe personal episodic memory, semantic memory and orientation of time. Findings showed that patients with frontal lesions produced significantly more confabulations on this test compared with patients with posterior lesions and healthy controls. Furthermore, a lesion analysis within the frontal lobe showed that patients who confabulated on episodic questions had orbital, medial and left lateral lesions. In contrast, patients who confabulated on questions that probed orientation showed orbital, medial and right lateral damage. Patients who produced confabulations above the normal cut-off on the confabulation battery had lesions in the orbital or inferior regions of the anterior cingulate cortex. Turner and colleagues (2008) concluded that lesions to the frontal lobes are crucial for the development of confabulation than any other brain region.

1.2. Theories of Confabulation

Neuropsychological theories have been proposed to explain the mechanisms responsible for confabulations. There are currently four established explanations of confabulation. These are: (1) the temporality theory, (2) the retrieval theory, (3) the constructive-memory framework and (4) the motivational theory.

1.2.1. Temporality Theories

The temporality hypothesis proposed that confabulation results from a distorted perception of time in the context of an amnesic syndrome. This theory explained that confabulating patients may remember the content of events but mistake their time of occurrence. Korsakoff (1889) proposed this hypothesis based on his observation that confabulation were often about events from past memories. Korsakoff postulated that recent memories are fragile and more likely to be forgotten in comparison to past memories. As past memories are more potent, they are often mistaken as new. More recently, two different explanations have emerged within the temporality perspective.

1.2.1.2. Temporal Consciousness Theory

Dalla Barba and colleagues (1993) proposed one explanation within the temporality perspective. They emphasised that the main impairment in confabulation is a distorted ‘temporal consciousness’ responsible for assigning memories to the correct time. This theory explained that confabulating patients are aware that their personal experiences comprise of a past, present and future. However, as confabulation is coupled with a memory deficit, there is a strain on temporal consciousness to perform a detailed search through autobiographical memory. Consequently, temporal consciousness is guided by the more stable memory traces (usually semantic memories). As a result, the confabulations produced often consist of the patients’ personal habits and established routines (Dalla Barba, 2009).

The temporal context theory has been supported by findings from observational studies. Dalla Barba and colleagues (1997) presented the case of a patient who started confabulating after lesions to the Anterior Communicating Artery (ACoA). Observations showed that the patient adhered more to her confabulations compared with her past experiences. This led to argue that the patient’s memory difficulties may be due to a temporal-consciousness deficit.

Subsequently, Dalla Barba and colleagues (1998) examined a patient diagnosed with confabulation following cardiac arrest. The patient was presented a recognition task where she was asked to identify photographs of familiar people and events. Findings showed that the patient correctly recognised significantly more photographs of people and events from the fifties compared with photographs from later decades. Furthermore, the patient produced more confabulatory errors during the recognition of photographs from the eighties. These errors decreased during the recognition of photographs from earlier decades. Dalla Barba and colleagues concluded that confabulating patients employ the most stable traces from their memory. Recent memories are more fragile and are less stable compared with past memories.

Limitation of the Temporal Consciousness Theory

One limitation of the Temporal Consciousness theory is that it mainly derived from observations. However, Dalla Barba’s observational studies led him to develop the confabulation interview. This is a test designed to identify confabulations in separate areas of memory including; personal semantic memory, episodic memory, orientation and general semantic memory. This test is currently the most recognised and widely used in detecting confabulatory symptoms in the clinical population (Dalla Barba, 1993). The present research adopted this procedure to examine confabulation in patients with memory disorders.

1.2.1.3. Temporal-Context Confusion Theory

Schnider and Ptak (1999) proposed the Temporal Context Confusion theory as an alternative explanation within the temporality perspective. The explanations provided by Schnider and Ptak referred to spontaneous confabulations. These are defined as bizarre erroneous memories that compel behaviour and occur without any provocation. According to this theory, spontaneous confabulations result from a failure to suppress irrelevant memories from intruding in the current reality. This theory emphasised that patients often confabulate about their past experiences and act on ideas that overlook their present circumstances (for example, an inpatient under medical care).

Schnider and colleagues (1996) implemented a temporal context confusion task (TCC) to support their theory of confabulation. They skilfully designed a recognition memory task that consisted of two trials. For the first trial, participants were presented with pictures. Some of the pictures were repeatedly presented (targets) while the rest (distracters) were shown once. The participants were then asked to identify the pictures that were previously presented in the trial. Temporal context confusion was examined in the second trial when the same pictures were presented to the participants. In this condition, the distracters from the first trial were repeatedly presented. The targets from the first trial appeared once and were now the distracters in the second trial. Therefore, the first trial was a simple learning and recognition task.

In contrast, the second trial increased the level of intrusion in all groups when targets from the first trial were presented as distracters. The second trial measured whether retrieval was influenced by items recently presented or items that appeared in the first trial (Schnider et al., 1996).

Schnider and colleagues (1996) presented the TCC task to confabulating and non-confabulating amnesia patients. They found that both groups showed a normal performance in the first trial. However, confabulating patients produced significantly more intrusions in the second trial compared with the non-confabulating patients. This led to conclude that confabulation results from an incapacity to reject previous memories that are irrelevant in the current context.

A follow-up study of the TCC task showed that performance on the second trial significantly improved in the patients who stopped confabulating. This finding increased the validity of the TCC task and supported the idea that temporal context confusion is an adequate explanation of confabulation (Schnider et al., 2000).

Limitations of the Temporal-Context Confusion Theory

Subsequent studies produced findings that questioned the reliability of the TCC task. Gilboa and colleagues (2006) presented the TCC task to twelve patients diagnosed with anterior communicating artery aneurysm (ACoA). Four of the ACoA patients displayed confabulatory symptoms while the remaining eight patients were amnesic in the absence of confabulation. Results showed that all four confabulating patients' underperformed on the TCC task. However, this was also observed in some non-confabulating ACoA patients. In contrast, healthy controls showed a normal performance in this task. This suggested that temporal context confusions may be a feature of ACoA amnesia patients rather than specific to patients who confabulate (Gilboa et al., 2006).

1.2.1.4. Limitations of the Temporality theories

Limitations of the temporality theories have been reported in the literature. Moscovitch argued that a temporal disorder is just one of the symptoms of confabulation and is not an adequate explanation (Moscovitch, 1995).

Another limitation for temporality theories is that a disordered sense of temporality has also been observed in non-confabulating patients. Difficulties recalling the temporal order of events have been observed in non-confabulating patients with frontal lobe lesions (Johnson et al., 1978; Vriezen and Moscovitch, 1999). In addition, Gilboa and Moscovitch (2002) argued that temporal disorder may not be the primary cause of confabulation. They believe that difficulty in remembering the temporal order of past events may be caused by a retrieval deficit (Gilboa and Moscovitch, 2002; Kopelman et al., 1997).

1.2.2. Strategic Retrieval Theories

Some theories postulated that confabulation is the result of a deficit in the retrieval system. These theories shared the view that confabulation is a memory deficit but differed on the specific faulty retrieval processes that may underlie confabulation (Burgess and Shallice, 1996; Gilboa and Moscovitch, 2002; Johnson et al., 1993; Kopelman, 1999; Mercer et al., 1977). There are currently three established explanations of confabulation within the retrieval perspective that are described below. These are: (1) the working with memory framework,

(2) the control process model of autobiographical reconstruction and (3) the constructive-memory framework.

1.2.2.1. The Working with Memory Framework

Moscovitch and Winocur (1992) hypothesized that confabulation is a consequence of frontal lobe dysfunction which affects the executive processes required for strategic search and the reconstruction of memories. Moscovitch and Winocur proposed the Working with Memory theory to explain confabulation. This theory described the processes that operate in order to retrieve memories. According to this theory, there are two types of retrieval processes: associative and strategic. Associative processes are automatic and are engaged when environmental cues interact with stored information. This interaction leads to the retrieval of the memory sought. However, if the cues are ineffective in finding the memory then strategic processes are needed for further memory search. The strategic process is active and relies on executive processes in order to organise the memory search and comprises the following stages:

1. Supervising search in order to frame the memory problem and identify related cues to acquire the memory.
2. The retrieved memory is monitored in order to determine its veracity.
3. The retrieved memory is placed in the correct temporal-spatial context.

Moscovitch and Melo (1997) applied the Working with Memory framework to confabulation and concluded that the strategic search deficit may underlie confabulation.

1.2.2.2. Control Process Model of Autobiographical Reconstruction

Burgess and Shallice (1996) argued that confabulation may be the result of deficits in the ‘descriptor’ processes that specify appropriate cues to guide memory retrieval. A defective specification may lead to an incorrect representation being mistakenly activated as the target memory. However, Burgess and Shallice explained that strategic search is just one of the disrupted memory processes in confabulators. They argued that confabulating patients may also have a monitoring deficit. They proposed that monitoring comprises two processes: ‘editing’ and ‘mediating’.

1. Editing processes involve continuously checking the accuracy of the memory and comparing it to other retrieved memories.
2. Mediator processes involve problem-solving used to monitor the general plausibility of the memory sought.

Burgess and Shallice’s theory and the Working with Memory Framework both share the view that there is a strategic search deficit in confabulation. However, while the Working with Memory Framework postulate that a strategic search deficit underlies confabulation, Burgess and Shallice argue that strategic search is just one of the disrupted memory processes in confabulating patients.

Burgess and Shallice (1996) explained that impaired editing processes result in confabulating patients producing memories without verifying their accuracy. Faulty mediator processes fail to check the plausibility of the retrieved memory processes which results in the production of bizarre confabulations. Burgess and Shallice concluded that a strategic search deficit and defective cue-memory associations are important processes but do not constitute a sufficient explanation of confabulation. They argued that confabulations could also arise as a result of a failure to monitor and edit erroneous memories.

Limitations of the Strategic Retrieval Models

Dalla Barba (2009) argued that strategic retrieval models are based on processes that are difficult to verify. Furthermore, Schnider (2001, 2008) argued that the monitoring processes described by these models have not been clinically studied and lack experimental evidence.

1.2.2.3. The Constructive Memory Framework

Schacter and colleagues (1998a) proposed a Constructive Memory Framework as an alternative retrieval theory of confabulation. This theory emphasised that deficits in both encoding and retrieval processes may underlie confabulation. Schacter and colleagues explained that memories of previous events are conceptualised as patterns of features distributed across different regions of the brain. During encoding, the features of an event link together as a coherent representation. The stored events should sufficiently separate from each other, a process referred to as pattern separation. An overlap of bound events may result in a failure to recall item-specific information that differentiates each event. Consequently, individuals retrieve the general theme of the event. To avoid this memory distortion, retrieval processes formulate a focused description of the event, which activates event-related features. Monitoring processes are then required for the accurate retrieval of the context of the event. If events are not accessed separately at retrieval or the description of the event is not sufficiently focused, this can result in confabulations.

All three strategic retrieval theories described above share the view that confabulation is the result of impairment to executive processes needed for memory construction (Moscovitch and Winocur, 1992; Burgess and Shallice, 1996; Schacter et al., 1998a). These impaired executive processes relate to strategic search or to the monitoring processes needed to guide retrieval.

One limitation of these theories is that they do not explain why many confabulations alter the patients' previous experiences so that they appear emotionally pleasant (Conway & Tacchi, 1996).

1.2.3. Motivational Theories

A difficulty for both the temporal and retrieval theories of confabulation is that they do not explain why the patients confabulate about a particular event over others. Clinical investigations have shown that the content of confabulation is usually self-referent and often relates to the patients' autobiographical experiences and future goals (Fotopoulou et al., 2008a; Metcalf et al., 2009). Motivational theories share the view that emotional mechanisms influence the content of confabulation. However, theories within the motivational perspective have differed on what emotional factors determine the content of confabulation. There are currently three established explanations within the motivational perspective. These are: (1) the Gap-Filling Hypothesis, (2) the Premorbid Personality Theory, (3) and the Self-Memory System Framework.

1.2.3.1. The Gap-Filling Hypothesis

An early motivational theory of confabulation is the ‘gap-filling’ hypothesis. This theory argued that confabulations are produced in order to fill the gaps in his/her memory and avoid the embarrassing feeling of not being able to remember personal events. Bonhoeffer (1901, cited in Talland, 1961) supported this view and suggested that confabulations are a response to a conscious compensatory mechanism.

However, Nadel & Moscovitch (1997) rejected this view because the current consensus is that confabulations are not intentional or inherently strategic. Lorente-Rovira and colleagues (2011) pointed out that in the definition of confabulation, it is understood that confabulating patients lack awareness of their memory deficit. Furthermore, Dalla Barba and colleagues (1993) presented confabulating patients with a set of questions where the answers are generally unknown (e.g. “how many Renault cars were sold in 1985?”). Similar to healthy controls, most confabulating patient responded with I-don’t-know answers. These findings rejected the gap-filling hypothesis and supported the notion that confabulations are produced unconsciously by the patient and are not contrived.

1.2.3.2. Premorbid Personality Theory

Williams and Rupp (1938) proposed an alternative motivational theory. They emphasised that confabulations are partly motivated by the patients’ premorbid personality traits. Talland (1961) agreed with this view and suggested that confabulations are determined by an interaction between the amnesic deficit and the patients’ dispositions.

The relationship between confabulation and premorbid personality traits has been observed in a series of clinical studies. These studies found that confabulating patients were often described by their relatives as introverts (Weinstein and Kahn 1955; Weinstein et al., 1956).

One limitation of this theory is that it does not explain how personality traits interact with the memory deficit and lead to the production of confabulations (Lorente-Rovira et al., 2011).

1.2.3.3. The Self-Memory System Framework

A current motivational theory emphasised that confabulation may be determined by both cognitive and emotional mechanisms (Conway and Pleydell-Pearce, 2000). This theory suggested that memory and executive mechanisms interact with processes that construct self-identity. This interaction is referred to as the self-memory system (SMS).

According to this theory, autobiographical memories are constructed within a SMS. Autobiographical memories are constructed from a knowledge database and are monitored by executive processes. Personal goals are produced by the working self and control access to the knowledge database by modifying executive processes. The SMS is composed of an interaction between the autobiographical knowledge database and the working self. It is postulated that a disruption to the interaction between these two components may lead to confabulations and other memory distortions (Conway and Pleydell-Pearce, 2000; Conway, 2005). The functions of these components are described below.

The Autobiographical Knowledge Database

The Autobiographical Knowledge Database comprises of knowledge about the self. This information is organised into three categories:

- Lifetime periods: general knowledge about a time in the individual’s life based on a particular theme. For example, starting college (college theme) or a period spent abroad (holiday theme).

- General events: knowledge about a set of events that share a common theme. For example, winning a race or passing exams are events that represent achievements.

- Event-specific knowledge: detailed knowledge of events that relate to personal goals. These include events that have led to planning goals and events that currently guide behaviour.

These categories form a hierarchical structure in the knowledge database. Knowledge about lifetime periods produces cues that elicit the retrieval of general events, and knowledge about general event activates event-specific knowledge. This pattern of activation gives access to all three knowledge categories and leads to the construction of autobiographical memories. Nevertheless, the production of autobiographical memories can be inhibited by executive mechanisms. Consequently, personal goals of the working self can constrain access to the knowledge database by modifying executive processes (Conway, 2005).

The Working Self

Memories processed in the knowledge database are evaluated by the working self before they are constructed and retrieved. The working self refers to a hierarchy of personal goals or self-representations that modulate the construction of specific memories. The goal hierarchy operates by controlling processes that determine accessibility of pre-existing knowledge. The main function of the working self is to assign accessibility of knowledge to memories that favour personal goals in order to achieve coherence between currently active goals (Conway and Pleydell-Pearce, 2000).

Another feature of the working self is that it rejects any knowledge that attempts to modify currently active goals. It is argued that changing current goals can be emotionally stressful and reduces the ability to operate effectively in the world. The coherence between current goals becomes disrupted and gives rise to discrepancies among three self-representations: the ‘actual self’ (are representations of one’s self-identity), the ‘ideal self’ (are representations of one’s personal goals) and the ‘ought self’ (are representations of how one should behave) (Higgis, 1987). The working self reduces self-discrepancies by inhibiting accessibility of memories that conflict with the goal hierarchy. These memories are altered or false memories are produced to support current goals in order to achieve coherence (Conway, 2005).

Nevertheless, goals that are unrealistic and oppose the knowledge database are rejected. For example, an individual’s goal of winning a football match is not accepted if knowledge about his/her skills cannot be remembered. Therefore, the autobiographical knowledge database constrains the goals in the working self. Goals that are plausible and based on accurate memories are maintained. Goals that conflict with the knowledge database indicate a dysfunction of the SMS. Accordingly, the construction of memories may be modulated by implausible goals and result in the production of confabulations.

Conway and Tacchi (1996) had previously reported a patient who displayed confabulatory behaviour following a closed head injury that damaged the temporal and frontal brain regions. The patient showed a tendency to produce confabulations that altered present circumstances into a time of happiness. Conway and Tacchi argued that the patient's memory distortions are the result of dysfunction to executive processes. Consequently, there is a disruption to autobiographical retrieval processes. This impairment also causes difficulties distinguishing memories from fantasies. In confabulating patients, fantasies are often mistaken as true because they serve to protect one's well-being.

The self-memory system framework has been applied to explain findings of the emotional biases in the content of confabulation. Evidence of the biases in confabulation is described below.

Evidence of the positive emotional bias in confabulation

There is very little research investigating the emotional content of confabulation. Recently, clinical observations of the positive bias in confabulations have emerged (Fotopoulou et al., 2008a; Fotopoulou et al., 2007a). These findings showed that confabulating patients contort past memories to be more positive and wishful in contrast to non-confabulating patients and healthy controls. For example, a confabulating patient may contort the reason for his hospital appointment with a pleasant confabulation about coming to work or visiting relatives. Therefore, these patients wish to maintain a coherent personal account as healthy and self-sufficient. It is argued that patient's wish for self-coherence may be due to a dysfunction of executive processes that guide the construction of memories based on the patient's reality. This deficit distorts the correspondence between memory and reality demands in a manner that personal goals influence memory construction. As a result, the memories produced appear implausible and exaggerate one's self-identity (Conway and Fthenaki, 2000; Conway and Tacchi, 1996; Fotopoulou et al., 2009).

Furthermore, Bajo and colleagues (2010) examined the content of true and false memories in 24 confabulating amnesia patients. They found that naïve judges rated the majority of patients' confabulations as either pleasant or unpleasant compared with 'true' memories. This study concluded that the content of confabulations have an emotional component but are not necessarily positive.

<u>Evidence of self-referent biases in confabulation</u>

Further observations have reported that the content of confabulation is frequently self-referent (Gilboa et al., 2006; Metcalf et al., 2010; Fotopoulou et al., 2008b). A selective bias to produce pleasant self-referent confabulations was observed in a prose recall task. Confabulating patients recalled the negative self-referent prose in a manner that represented a positive self-image. This selective bias was not observed when these patients recalled non-referent prose. This finding suggested that confabulating patients recall is prone to motivational distortions due to deficits in the control and monitoring of retrieval processes.

Comparatively, self-enhancement biases in autobiographical recollection have also been observed in older adults (Mather and Carstensen, 2005). Older patients often showed frontal brain impairments similar to confabulating patients. This suggested that the tendency to exaggerate one's self-identity through memory reconstruction may be caused by a dysfunction to executive processes (Fotopoulou et al., 2009).

Evidence of the relationship between low mood and positive confabulations

Fotopoulou and colleagues (2008a) obtained paradoxical findings showing that positive confabulations are associated with depression. These results showed that the higher the patients' rating on the depression scale, the greater the production of pleasant and self-enhancing confabulations. This correlation led Fotopoulou (2009) to suggest that confabulations are an adaptive or defensive function that serves to maintain self-esteem and a positive temperament. However, this explanation of confabulation raised doubts as clinical observations have consistently reported confabulations that convey a negative self-concept. For example, confabulations about the death of a relative have been reported in the literature (Metcalf et al., 2010; Gilboa, 2010). This suggested that the positive emotional bias in the content of confabulations is not universal (Metcalf et al., 2010). Metcalf and colleagues (2010) concluded that the content of confabulations reflect a personal bias to retrieve memories that support past self-representations in order to maintain self-coherence. These past self-representations can be either positive or negative and are congruent to the individuals past experiences (pleasant or unpleasant).

1.2.3.4. Limitations of the Motivational Theories

One limitation of the motivational account of confabulation is that it is based on very few experimental studies (Fotopoulou et al., 2008a; Fotopoulou et al., 2008b; Metcalf et al., 2010; Bajo et al., 2010). In addition, studies examining motivational factors in confabulation used naïve judges to analyse the content of confabulations (Fotopoulou et al., 2004). These judges were asked to rate the emotional valence of each confabulation on a seven-point scale. Related to this, it has been argued that findings based on a rating system are vulnerable to biases (Hoyt, 2000). For example, rating whether a narrative is ‘somewhat positive’ or ‘positive’ is ambiguous and depends on the judges’ own interpretations. Several studies have shown biases in judgement and decision making (Kerr et al., 1996; Hilbert, 2012). These biases may lead to inaccurate results and reduce the validity of the study.

Alternative experimental methods are yet to be introduced to investigate the emotional triggers of confabulation. As a result, the present research used the semantic-associates procedure to examine the emotional biases in confabulation. This procedure, also known as the Deese-Roediger-McDermott (DRM) procedure, was initially developed by James Deese (1959). This procedure was used to investigate the intrusion of non-studied words after learning semantically related word lists. Previous studies have employed this procedure in healthy controls and amnesia patients in order to examine systematic differences in false recall and false recognition in memory (Schacter et al., 1998b; Melo et al., 1999; Ciaramelli et al., 2006). However, this procedure has not been previously used to examine the role of emotions in the content of confabulation. The semantic-associates procedure is described in detail below.

1.3. Semantic Associates Procedure

False recognition is a type of memory distortion that has received wide research interest. False recognition is a term used to define an erroneous assertion that a novel item was previously presented (e.g.: word, event or person). Previous research has consistently observed the false recognition phenomenon in the semantic-associates procedure.

This procedure was first employed in the healthy population where participants were presented with 36 lists of words. Each list consisted of 12 word associates to one non-presented critical distracter. For example, the critical distracter ‘butterfly’ formed this list of associates: moth, insect, wing, bird, fly, yellow, net, pretty, flower, bug, cocoon and colour. A free recall test was administered immediately after the presentation of each list. Findings using this procedure showed that healthy participants tended to produce a critical distracter in response to its association to the words on the list (Deese, 1959).

Roediger and McDermott (1995) later replicated and extended the semantic-associates procedure using recognition tests. They constructed 24 lists that each comprised 15 word associates from a critical distracter. Roediger and McDermott examined whether participants would falsely recall and falsely recognise critical distracters. After the free recall tests, participants were presented a recognition test where they were asked to respond ‘old’ or ‘new’ to

48 of the previously studied words. These words were selected from each of the 16 study lists, from serial positions 1, 8 and 10. The recognition test also included 16 critical distracters and 8 non-studied words that were unrelated to the previously studied lists. Roediger and McDermott reported that participants produced a higher rate of false recognition (55%) than false recall (40%) for critical distracters (Roediger and McDermott, 1995). This finding was replicated when the procedure was carried out in different modalities where the lists of associated items were presented in written, auditory and pictorial conditions (Schacter et al., 1997; Ciaramelli et al., 2006; Koutstaal et al., 2001).

Explanations for false recall and false recognition in the semantic-associates procedure

Schacter and colleagues (1998a) argued that the false recall and false recognition effect produced by the semantic-associates procedure may be the result of a faulty pattern separation. Schacter postulated that studying lists of word associates causes the item representations to extensively overlap. Consequently, participants recall the gist of the list and fail to remember item-specific information. This causes a difficulty in distinguishing between studied words and non-studied intrusions.

Reyna and Brainerd (1995) proposed a similar explanation within the fuzzy-trace theory. They suggested that information is encoded into two different memory traces: verbatim and gist. Verbatim traces are memory representations about the item-specific details of the studied item. Gist traces are representations about the overall theme of the studied items. In the semantic-associates task, words that correspond to the theme of the list are favoured because the gist traces are stronger. Consequently, critical distracters are falsely recalled because they evoke a strong sense of familiarity to the studied list.

The semantic-associates procedure was subsequently employed in clinical populations. This procedure was often used to examine false recognition in the following groups of patients: 1) non-confabulating amnesia patients, 2) patients with frontal lobe lesions, 3) patients with false recognition syndrome and 4) confabulating amnesia patients.

1.3.1. The Semantic Associates Procedure in Non-confabulating Amnesia Patients

Schacter and colleagues (1998b) employed the semantic-associates procedure to examine false recognition in non-confabulating amnesia patients and healthy controls. As predicted, findings showed that non-confabulating amnesia patients recognised a significantly lower proportion of previously studied (target) words compared with healthy controls. However, the non-confabulating amnesia patients also falsely recognised a lower proportion of critical distracters compared with healthy controls. Interestingly, these patients falsely recognised more unrelated intrusions than critical distracters. These findings were replicated by further studies using the semantic-associates procedure. These studies concluded that non-confabulating amnesia patients have a tendency to show reduced false recognition to critical distracters compared with healthy controls (Schacter et al., 1998b; Melo et al., 1999; Ciaramelli et al., 2006).

1.3.2. The Semantic Associates Procedure in Patients with Frontal Lobe Lesions

Previous studies have also observed high levels of false recognition in patients with frontal lobe lesions (Parkin et al., 1996; Schacter et al., 1996; Delbecq-Derouesné et al., 1990). They argued that this memory distortion, called the false recognition syndrome, is not necessarily related to spontaneous confabulation. In contrast to confabulation, patients with false recognition syndrome show relatively intact episodic memory. These studies found that the rate of false recognition in these patients increased when the test items were related to the overall theme of the studied list. This suggested that any item that evoked a sense of familiarity was falsely recognised.

Subsequent studies using the semantic-associates procedure found that patients with Alzheimer's disease showed elevated levels of false recognition across repeated trials compared with healthy controls (Balota et al., 1999; Budson et al., 2000). Budson and colleagues (2002) postulated that the frontal lobe impairment that coincides with Alzheimer's disease may be responsible for the high rate of false recognition in these patients. To examine this hypothesis, Budson and colleagues (2002) examined false recognition in patients with frontal lobe lesions and age-matched healthy controls. The two groups were presented with the semantic-associates procedure across repeated study-list trials. Patients with frontal lobe damage showed increasing levels of false recognition across the trials. In contrast, healthy controls showed reduced false recognition the more trials they did. These findings led to suggest that impairment of the frontal lobes may be contributing to Alzheimer's patients' failure to suppress false recognition across repeated trials.

1.3.3. The Semantic Associates Procedure in Confabulating Amnesia Patients

Melo and colleagues (1999) administered the semantic-associates procedure to three different groups of patients: 1) amnesia patients with medial temporal lobe (MTL) damage, 2) amnesia patients with frontal lobe damage and 3) non-amnesic patients with frontal lobe damage. Three out of the four patients in the frontal lobe amnesia group were diagnosed as exhibiting confabulatory symptoms during the time of the study. This study found that both MTL amnesia patients and frontal lobe amnesia patients showed reduced false recognition to critical distracters, but increased levels of false recognition to unrelated intrusions. Therefore this study showed that reduced false recognition to critical distracters is a tendency found in both confabulating and non-confabulating amnesia patients. The results from this study contrast with the findings obtained in patients with false recognition syndrome. While confabulating patients showed reduced false recognition (Melo et al., 1999; Ciaramelli et al., 2006), patients with false recognition syndrome showed an increased rate of false recognition (Schacter et al., 1996; Parkin et al., 1996; Delbecq-Derouesné et al., 1990). Therefore these findings suggest that confabulation and the false recognition syndrome may be two separate memory disorders.

Ciaramelli and colleagues (2006) conducted a similar study using the semantic-associates procedure. They examined false recognition between three groups of amnesia patients: 1) confabulating amnesia patients with ventromedial lesions, 2) non-confabulating amnesia patients with frontal lesions and 3) amnesia patients with non-frontal lesions. These three patient groups were also compared with a healthy control group. All three groups of amnesia patients falsely recognised a lower proportion of critical distracters compared with healthy controls when presented with the “standard” semantic-associates procedure. There were no significant differences between the amnesia groups on the rate of false recognition to critical distracters. However, the confabulating group falsely produced significantly more unrelated intrusions compared with the non-confabulating patients with non-frontal lesions (Ciaramelli et al., 2006). Therefore, this study supports Melo’s finding that confabulating patients show increased levels of false recognition to unrelated intrusions, but reduced false recognition to critical distracters.

Explanations for false recall and false recognition in the amnesic population

Schacter and colleagues (1996) postulated a deficit in non-confabulating amnesia patients’ gist representation. They suggested that healthy participants form a link between the words in the studied list and construct a coherent gist representation. As critical distracters fit the gist representation, they elicit a strong sense of familiarity and are often falsely recognised as previously studied words. In contrast, non-confabulating amnesia patients retain limited gist information and form a weak link between the studied words. This impairment makes it difficult for amnesia patients to remember the previously studied list. As non-confabulating amnesia patients have a poor gist representation, they are less susceptive to critical distracters compared with healthy controls. During the recognition test, this poor gist representation causes a difficulty in distinguishing between studied and non-studied words. Schacter and colleagues gist memory theory derived from a series of studies examining false recognition in non-confabulating amnesia patients using the semantic-associates procedure. Therefore, this theory does not relate to confabulating amnesia patients.

Koutstaal and colleagues (1999) suggested that false recall and false recognition of critical distracters may be due to source confusions in the standard semantic-associates paradigm. In this procedure, the studied lists are presented in auditory or written form. They argued that when presented with a list of semantically related words, elaborative processes may “generate” the critical distracter during encoding and/or retrieval. Consequently, participants confuse the origin of the critical distracter in terms of whether the word was previously studied or spontaneously generated. Koutstaal and colleagues postulated that amnesia patients may show reduced false recall and false recognition of critical distracters due to an inability to generate the critical distracter during learning and/or retrieval.

Koutstaal and colleagues (2001) examined whether non-confabulating amnesia patients low rate of false recognition is due to a gist memory deficit. They argued that pictorial and visual modalities provide distinctive perceptual information and reduce any possible source confusions. They also argued that, unlike the standard semantic-associates paradigm, this procedure provides a clear measure of gist-based false recognition because the conditions of conceptual and perceptual similarly provoke false recognition. On this basis, Koutstaal and colleagues presented a pictorial semantic-associates task to non-confabulating amnesia patients. Patients were presented with pictures of common items in each category (for example: birds, teddy bears or flowers). Subsequently, these patients were presented with a recognition test that comprised previously studied pictures, unrelated pictorial intrusions and category-related pictorial distracters. Findings showed that the non-confabulating amnesia patients falsely recognised significantly less category-related distracters compared with controls. Koutstaal and colleagues concluded that these findings support the notion of gist memory impairment in non-confabulating amnesia patients (Koutstaal et al. 2001).

Israel and Schacter (1997) used the pictorial semantic-associates paradigm in a series of experiments and found that this procedure reduced false recognition of critical distracters compared with the standard procedure where words were used instead of pictures. Israel and Schacter suggested that limited access to item-specific information in the standard semantic-associates procedure contributes to false recognition. They argued that the studied items in the pictorial semantic-associates procedure comprise of distinctive perceptual representations that reduces the rate of false recognition. However, the pictorial semantic-associates procedure has not been examined in confabulating amnesia patients. The present research constructed a pictorial semantic-associates procedure using emotional facial expressions in order to examine whether confabulating patients would show the positive emotional bias when the studied items are pictorial. The present study aimed to address whether confabulating patients low rate of false recognition is due to degraded gist memory.

The present research also aimed to examine whether pictorial information reduces false recognition in all three groups of participants. To address this, the present research compared false recognition data between study 1 and study 2. In study 1, the associates list comprised of written words while study 2 comprised of facial expressions. Based on Israel and Schacters' theory that pictorial information reduces false recognition, the present study investigated whether participants' rate of false recognition is significantly lower in study 2 compared with study 1.

Recently, Ruci and colleagues (2009) examined mood congruent false memories in healthy participants using the semantic-associates procedure. They used positive, negative and neutral word lists from Roediger and colleagues (2001). They induced participants into negative and positive mood states by asking them to read a story entitled the 'The Lottery Ticket'. Participants were also asked to use their imagination in order to simulate the emotions that were being depicted in the story. They found that participants falsely recognised more critical distracters that matched the mood state induced during the time of learning the studied lists. This affective method has not been previously used in the clinical population. The present study similarly uses Roediger and colleagues (2001) positive, negative and neutral studied lists to examine the positive emotional bias in confabulating amnesia patients.

Some of the key theories and evidence described in the previous sections are briefly reviewed below to raise the questions under investigation in the present research project.

1.4. Rationale

To summarise, Fotopoulou and colleagues (2009) suggested that the content of confabulation is positive and self-enhancing. They also argue that confabulations serve to protect the patients' well-being from difficult and emotionally distressing situations. This view has been contradicted by evidence that showed confabulations sometimes conveyed unpleasant self-concepts (Metcalf et al., 2010; Gilboa, 2010). To conclude, there is inconsistent evidence regarding the role of emotions in confabulation. Furthermore, current research methods examining the emotional content of confabulations are vulnerable to inaccuracies. These studies ask naïve judges to evaluate the emotional valence of confabulations. Biases in judgment may influence the naïve judges' interpretations and lead to inaccurate findings. On this basis, alternative research methods are needed to investigate the emotional triggers of confabulation (Fotopoulou et al., 2008a). The semantic-associates procedure has been employed to induce confabulatory responses in both the healthy and clinical population. To date, this procedure has not been implemented to examine the content of confabulation. Therefore, the present research aimed to examine the emotional biases in the content of confabulations using the semantic-associates procedure. The present research modified the semantic-associates procedure to incorporate affect using positive, negative and neutral associates to non-presented critical distracters.

Related to this, Koutstaal and colleagues (1999) argued that the standard semantic-associates procedure may evoke source confusion that result in false recall and false recognition of critical distracters in healthy participants. The contrasting findings observed in non-confabulating amnesia patients' may be due to a failure to generate the critical distracter. On this basis, Koutstaal and colleagues (2001) constructed the pictorial semantic-associates procedure to reduce source confusions because pictorial information is more conceptually detailed and enhance encoding processes. Using the pictorial semantic-associates procedure, Koutstaal and colleagues found that non-confabulating amnesia patients falsely recognised a lower proportion of category-related distracters in contrast to controls. These findings led Koutstaal and colleagues to support the notion of degraded gist memory in amnesia. However, previous studies have not examined the pictorial semantic-associates procedure in confabulating amnesia patients. The present research used emotional facial expressions to construct a pictorial semantic-associates procedure in order to examine whether pictorial information influences the positive emotional bias in confabulating amnesia patients.

Furthermore, Fotopoulou and colleagues (2008a) found an association between depressed mood and pleasant confabulations. This led them to suggest that confabulations serve to maintain the patients' well-being. However, these findings indicate an association between mood and confabulations and do not address whether pleasant confabulations are caused by negative mood states. Therefore, the present research also aimed to investigate the effects of mood on the content of confabulation. Participants were induced to positive and negative mood states before the presentation of positive, negative and neutral associates.

In conclusion, an affective semantic-associates procedure was employed in three separate studies to address the aims below. The methods used to address these aims are described in the next chapter:

1. To examine emotional biases in content of confabulation.
2. To examine the positive emotional bias in confabulation using a pictorial semantic-associates procedure.
3. To investigate the effects of mood on the content of confabulation.

CHAPTER TWO

Methods

2.1. Introduction to Methods

This chapter will begin by discussing ethical approval, background neuropsychological tests, and the inclusion and exclusion criteria that were involved in the current set of studies. In the later part of this chapter, the experimental procedures and the statistical analyses employed for each of the three studies will be discussed.

2.2. Research Ethics Approval

The North West London Ethics Committee granted the present research project a favourable ethical opinion. With regard to the specific issue of patients who lack capacity under the Mental Capacity Act (2005), the committee stated that informed consent must be sought from the patient's next-of-kin. The committee also stated that if the patient is thought to have gained the ability to give informed consent during the time of the study, the researcher must go through the information sheet with them and seek a written consent retrospectively. If the patient wished to withdraw, their research data must be destroyed. The researcher adhered to these protocols successfully. Subsequently, two substantial amendments were also approved which granted the permission to recruit patients from the Care Plus Partnership rehabilitation centre and use patients' clinical MRI scans for the purposes of the research. The present research was also granted R&D approval from each recruitment site. Site-specific approval was also granted for this research by Camberwell St Giles Ethics Committee, which gave permission to recruit healthy volunteers from

King’s College London. The ethics committee and the R&D offices received annual monitoring reports regarding the research.

2.2.1. Recruitment sites

Patients were recruited from the following NHS Foundation Trusts: South London and Maudsley NHS Foundation Trust, Guys’ and St. Thomas’ NHS Foundation Trust and the Edgware Brain Injury Rehabilitation Centre.

Patients were also recruited from an independent rehabilitation centre in South East London called the Care Plus Rehabilitation Partnership.

Volunteers for the healthy control group were recruited from King’s College London. These participants were recruited by sending a circular email advertising the study to all members of staff, students and volunteers (see Appendix 2.1 and 2.2). The participant inclusion and exclusion criteria for this study are discussed later in this chapter.

2.2.2. Recruitment and Informed Consent – Confabulating and Non-confabulating Patients

Clinicians from the different recruitment sites notified the researcher if they identified their patient as clinically amnesic either additionally confabulating or non-confabulating. The clinicians provided information about the study to patients who met the research criteria. The patient was also asked whether he/she would be willing to be approached by the researcher. If granted permission, the researcher approached the patient about the purpose of study and read the information sheet before informed consent was sought. During this time, the researcher examined whether the patient was able to give informed consent drawing on advice from the patient's clinician. If the patient lacked capacity, the patient's informant was approached and provided with an alternative information sheet. Once written consent was obtained, patients were invited to take part in the study.

2.2.3. Recruitment and Informed Consent – Healthy Volunteers

The researcher identified healthy participants for this research by sending a circular email about the study to all members of King's College London. The email explained the purpose of the study, procedures, inclusion and exclusion criteria and the researcher's contact details (see Appendix 2.1 and 2.2). Individuals who expressed an interest in participating were given an information sheet before written consent was sought. Participants were then invited to take part in the study.

2.3. Background Neuropsychological Tests

All participants in the present research were administered the background neuropsychological tests described below. Some patients had been administered the background tests for clinical screening prior to being recruited for this study. In these cases, the chosen background tests were not performed if they had been previously administered by their respective clinical care team within four months of being recruited to this study.

Only the confabulating and non-confabulating amnesia groups were administered the Dalla Barba confabulation interview. The veracity of the patients' answers to this interview was then checked using the designated informant's knowledge.

2.3.1 Screening measures used to categorise participants into confabulating, non-confabulating and control groups.

The Dalla Barba confabulation interview (Dalla Barba, 1993)

Rationale: The Dalla Barba confabulation interview was used as a screening measure to allocate participants into the confabulating and non-confabulating amnesia groups. The present research used an adapted UK version of the Dalla Barba Confabulation Battery (Kopelman et al., 1997, see Appendix 2.3).

Measure: The confabulation battery was developed to provoke confabulations by asking patients some questions that probe different areas of memory: These included: personal semantic (e.g. age, address, marital status, etc.), episodic (e.g. "What did you eat for dinner yesterday?"), general semantic memories (e.g. "Who is Winston Churchill?") and orientation in time and place (e.g. "What is the date today?"). The battery also included "I-don't-know" semantic questions (e.g.: "How many Renault cars were sold in 1985?") and "I-don't-know" episodic questions (e.g.: "What did you do on the 13th of March 1985?"). Dalla Barba (1993) found that confabulating patients showed a normal performance and did not produce confabulatory answers on the "I-don't-know" questions in the interview. Conversely, Van Damme and d'Ydewalle (2010) conducted a recent study and found that confabulating patients presented with "I-don't-know" questions produced more confabulatory answers compared with healthy controls.

Analysis: The present research used Dalla Barba's scoring criteria to analyse patients' answers to the questions on the confabulation battery. For personal semantic and episodic questions, responses that were verified as false by the patients' informant (i.e. relative or carer) were scored as confabulations. Questions from the other memory sections had obvious answers (e.g.: "what year are we in?") and did not require verification from the patient's informant.

Scoring criteria for confabulation: There is currently no standardised cut off score for confabulation on this confabulation battery. It has been consistently reported in the literature that confabulating patients produce more confabulatory responses to the episodic questions on the Dalla Barba confabulation battery (Dalla Barba, 1993). Kopelman and colleagues (1997) found that patients produced 8 or more confabulatory responses in the episodic section of the confabulation battery. Subsequently, Bajo and colleagues (2012) used a cut-off score of 8 in the episodic section as an inclusion criterion for recruiting confabulating patients in their study. This criterion was adopted for this study to define the amnesic confabulating group, with the amnesic non-confabulating group having a score of 4 or less in this section of the test. For both groups, there had to be a clinical diagnosis of amnesia.

The Hospital Anxiety and Depression scale (HADS) (Zigmond and Snaith, 1983).

Rationale: The Hospital Anxiety and Depression scale (HADS) was used as a screening measure in this study to exclude participants with serve depression.

Measure: The HADS is a self-report rating scale that measures symptoms of anxiety and depression. It consists of seven scale items that pertain to anxiety and a further seven scale questions that pertain to depression. While there are varieties of published mood scales, the HADS was employed in the present research for the following reasons:

1. It is a recognised measure for identifying depression and anxiety in patients with physical disorders (e.g.: Encephalitis and brain haemorrhage).

2. Zigmond and Snaith (1983) argued that questionnaires that measure symptoms of mood disorders are sometimes affected by physical illnesses such as insomnia and fatigue. They developed the HADS questionnaire to prevent an increased depression scale score in patients with such symptoms by basing the questions purely on the cognitive symptoms of anxiety and depression.

Analysis: A score greater than 8 on the depression item scale is suggestive of severe depression. Similarly, a score greater than 8 on the anxiety item scale is suggestive of an anxiety disorder.

2.3.2 Neuropsychological cognitive tests used to estimate premorbid and current intellectual functioning.

<u>National Adult Reading Test Revised (NART–R) – Measure of Premorbid Intellectual Ability (Nelson and Willison, 1991)</u>

<u>Rationale:</u> The NART-R is used to estimate the participants' premorbid intellectual functioning.

<u>Measure:</u> The NART-R measures the ability to correctly pronounce a list of 50 phonetically irregular words.

<u>Analysis:</u> The number of errors on the NART-R test can be used to generate a predicated full scale IQ (FSIQ), verbal IQ (VIQ) and performance IQ (PIQ). Predictions of WAIS-III IQ scores were obtained using both the NART-R and WAIS-III manuals.

<u>Wechsler Abbreviated Scale of Intelligence Two Subtests (WASI) (Wechsler, 1999)</u>

<u>Rationale:</u> The WASI subtests were used to estimate the participants' current intellectual capacity. This test was also used as a screening measure to ensure that the participants recruited had a minimum IQ of 80.

<u>Measure:</u> the abbreviated version of the WASI was used with two subtests, as described below:

- Vocabulary – Participants were asked to describe the meaning of 42 words, presented verbally and also on a list.

- Matrix Reasoning – Participants were presented with different designs that had a piece missing. They were asked to complete each design by choosing the correct piece from a multiple choice.

Analysis: Raw scores were converted to a full scale IQ score using the protocols set out in the WASI manual.

2.3.3. Neuropsychological cognitive tests used to measure verbal and nonverbal recall and recognition memory.

Wechsler Memory Scale Subtests - Fourth Edition (WMS-IV) (Wechsler et al., 2009)

Rationale: The WMS-IV subtests were used to measure immediate visual and verbal memory. These subtests were also used as a screening measure in order to match the confabulating and non-confabulating amnesia groups on the severity of their memory disorder.

Measure: Three different subtests within the WMS-IV were used as described below:

- Logical Memory 1 – Participants were asked to listen to a short story, which they were then immediately asked to recall.

- Verbal-Paired Associates 1 - Participants were presented with a list of auditory word pairs. Four of the word pairs were semantically related (e.g.: “sky and cloud”) while ten were unrelated (e.g.: “paint and big”). After the presentation of the list of word pairs, participants were presented with the first word and asked to recall the companion word. This procedure is repeated four times for the word pairs, presented in a different order.

- Visual Reproduction – Participants were presented with 5 pictures. Each picture was displayed for only 10 seconds and then the participant was asked to draw it immediately from their memory.

Analysis: Participants’ responses to the subsets were scored and analysed using the WMS-IV manual. All raw scores were adjusted to scaled and percentile scores.

Recognition Memory Test (RMT) – Measure of Verbal and Non-verbal Memory (Warrington, 1984)

Rationale: The RMT was used to measure participants’ ability to retain verbal and visual information.

Measure: The RMT is a memory test that comprises two forced-choice recognition tasks. The first test measures recognition of 50 words (RMW) and the second test measures recognition of 50 faces (RMF). These tests are used to assess verbal and visual memory deficits respectively and were originally developed as a screening measure in amnesia patients (Warrington, 1974).

Analysis: Raw scores were converted into percentile scores using the RMT manual.

2.3.4. Neuropsychological cognitive tests used to measure executive functioning.

The Hayling and Brixton Tests – Measure of Executive Functioning (Burgess and Shallice, 1997)

Rationale: Executive functions are the processes that regulate memory and other cognitive processes. The Hayling and Brixton Tests were used to assess participants executive functioning.

Measure: This measure comprises the Hayling Sentence Completion Test and the Brixton Spatial Anticipation Test. The Hayling Tests comprise two sections and are described below. This is followed by a description of the Brixton test.

- Hayling Sensible Completion – Participants are presented with 15 sentences. Each sentence is incomplete and has the last word missing. The participant's task is to give a word which correctly completes the sentence as quickly as possible. Scoring on this test is based on the time the participant takes to respond. This test is used to measure the ability to instigate a timed response.

- Hayling Unconnected Completion – Participants are presented with a further incomplete 15 sentences. This time they have to give a word that is completely unrelated to the sentence as quickly as possible. This test generates two sets of scores: the first score is based on the time the participant takes to respond and the second score is based on whether the participant's response word is (correctly) unconnected, somewhat connected or (incorrectly) connected to each sentence. This test is used to measure the ability to suppress prepotent responses.

- The Brixton Test – this test comprises 55 pages that all have the same design, a two by five grid, indicating 10 possible locations of a single filled blue dot. On each page the dot is in a particular location, and this location changes with each new page. In doing so, the movement of the dot follows a particular pattern. Participants' task is to pick up on the pattern of the moving blue dot and predict the location it will go to next as each page is turned. After a pattern sequence, the pattern changes to a new one. This test is used to measure the ability to identify the pattern and also respond appropriately to the change in the patterns.

<u>Analysis:</u> Raw scores were converted to scaled and percentile scores using the manual.

2.4. Sample Power Analysis

A power analysis was carried out to determine the number of participants needed for the present programme of studies. This analysis aimed to estimate the sample size needed in order to identify a significant difference between confabulating and non-confabulating patients in their performance on the semantic-associates procedure, as described below.

The power analysis was carried out using Ciaramelli and colleagues (2006) false recognition findings from confabulating patients and healthy controls. The false recognition means and standard deviations from Ciaramelli's study and corroboration from a statistician suggested that a sample size of 13 participants in each group with an effect size of 1.18 would provide 80% power at an alpha of 0.05.

2.5. Participants

This research project comprised three studies. Each study involved three groups of participants: 13 confabulating amnesia patients, 13 non-confabulating amnesia patients and 13 healthy controls. The participants recruited for the first study also took part in the second study. Thirty-nine new participants were recruited for the third study where each of the three groups comprised 13 participants.

2.5.1. Inclusion Criteria

Patients recruited for this research had to have a clinical diagnosis of amnesia. Patients also had to score 1.5 or more standard deviations on the Wechsler memory subtests below what was expected on the basis of their current measured IQ.

Inclusion criteria for confabulating patients

Patients who were clinically diagnosed as producing confabulatory responses by the clinician were recruited to the confabulating amnesia group. In addition, the patients had to also have a minimum score of 8 on the episodic section of the Dalla Barba Confabulation Battery (Dalla Barba, 1993; Kopelman et al., 1997; Bajo et al., 2012).

Inclusion criteria for non-confabulating patients

Patients who were clinically diagnosed with amnesia in the absence of confabulatory behaviour were recruited to the non-confabulating amnesia group. These patients had to also score 4 or less on the episodic section of the Dalla Barba Confabulation Battery (Dalla Barba, 1993; Kopelman et al., 1997; Bajo et al., 2012).

Inclusion criteria for healthy controls

Volunteers who had no history of physical and neurological disorders were recruited to the healthy control group. On this basis, they were not administered the Dalla Barba Confabulation Battery. These participants were matched to the confabulating and non-confabulating groups based on age, gender, level of education and WASI IQ.

2.5.2. Exclusion Criteria

Participants with specific learning disabilities and who were unable to complete psychometric reading tests were excluded from the study.

Participants who were clinically diagnosed with severe depression and who scored greater than 8 on the depression and anxiety scales of the Hospital Anxiety and Depression Scale (HADS) were excluded.

Participants who had high WASI IQ scores that did not match the confabulating group approximate mean WASI IQ score were excluded from this study.

An informant (i.e. next of kin or a carer) was used to verify the patient's confabulatory responses to the autobiographical memory questions on the Dalla Barba confabulation battery. Patients who did not have an informant were excluded from participating in this study.

2.6. Ascertainment

Several participants were approached for this research project. However, not all of the participants who were assessed took part in these studies. The participants approached in this research project are described in detail below.

<u>Confabulating Patients:</u> In all, 33 confabulating patients were approached for this research. Two patients rejected the invitation to take part in the study. Two patients scored below 80 IQ points on the WASI two subtests and were excluded, as they did not fit the screening criteria. Three further patients were excluded because they did not have a personal informant present to verify their responses on the Dalla Barba confabulation interview.

<u>Non-confabulating Patients:</u> A total of 30 non-confabulating patients were approached for this research. Two of these patients rejected the invitation to

take part in the study. Two further patients were excluded because they did not have a personal informant present to verify their responses on the Dalla Barba confabulation interview.

Healthy Controls: 32 healthy volunteers were approached for this research. One participant was excluded after not attending two screening appointments. Another participant later decided to not take part due to work commitments. Four participants were excluded because they had high WASI IQ scores that did not match approximately the experimental group. This left a total of 26 healthy volunteers that participated and completed all neuropsychological and experimental procedures.

2.7. Experimental Procedures

Three separate studies were conducted to address the following aims:

4. To examine emotional biases in content of confabulation.
5. To examine the positive emotional bias in confabulation using a pictorial semantic-associates procedure.
6. To investigate the effects of mood on the content of confabulations.

An affective semantic-associates procedure was used in each study to address these aims. The measures used to construct the affective semantic-associates procedure for each study are described below:

2.7.1. Study One – Affective Semantic-Associates Procedure

Rationale: The first study aimed to examine the emotional biases in the content of confabulation.

Measure: An affective semantic-associates procedure was constructed using 9 lists of word associates from Roediger and colleagues (2001). The 9 lists comprised 3 positive, 3 negative and 3 neutral word lists (see Appendix 2.4). Each list consisted of 15 words, all associated with the same non-presented critical distracter. Each word was printed on an A5 card and was displayed in a booklet. The positive, negative and neutral lists were separated into three display booklets in order to counterbalance the order in which they were presented to each participant.

After each list was presented, a recall test was administered immediately. The recognition test was then administered. This test was constructed by displaying a total of 36 previously studied words. These words were selected from each of the 9 study lists, from serial positions 1, 2, 12 and 15. Roediger and McDermott' (1995) constructed their recognition test using studied words from serial position 1, 8 and 10 although they did not give reasons for why they had chosen these positions. However, the nature of the semantic-associates procedure is that the first word in each list is the most associated to the critical distracter, while the second word in the list is the second most associated to the critical distracter. The lower the word is on the list, the least association it has to the critical distracter. For this reason, the recognition test in the present study comprised a previously studied word that was highly associated to the critical distracter (word from position 1), a word that was the least associated to the critical distracter (word from position 15) and words that were somewhat associated (words from position 2 and 12). The recognition test therefore comprised previously studied words with varying degrees of association to the critical distracter.

The recognition test also included 9 critical distracters and 36 non-presented words that were unrelated to the previously studied lists. Each word was printed on an A5 card and was displayed in a booklet. The studied words, critical distracters and unrelated intrusions were all presented in a single display booklet. The 36 unrelated intrusions were also used from Roediger and colleagues (2001). They examined false recall in healthy participants and presented 55 word lists. In the present study, 9 word lists were used as studied lists for 3 word categories (positive, negative and neutral). Thirty-six words from the remaining word lists from Roediger and colleagues (2001) were selected as unrelated intrusions based on their emotional valence. This approach was used from Ruci and colleagues (2009). They argued that affective unrelated intrusions from Roediger and colleagues' (2001) unused word lists make a good contrast because they have been previously used in the semantic-associates procedure.

One limitation of the semantic-associates procedure is that participants are administered a recall test immediately after the presentation of each word list. After recall tests have been administered for all the word lists, participants are then administrated a recognition test. Therefore, the nature of this procedure means that there is a longer duration between the study phase and the recognition test. Due to this delay, the rate of false recognition may increase as a consequence of forgetting. Despite this limitation, this procedure has been widely used in false memory research and is currently the only recognised approach to experimentally inducing false recall and false recognition.

Procedure: All three groups of participants performed the affective semantic-associates procedure in approximately 1.5 hours. Healthy controls completed this procedure in approximately 45 minutes.

Analysis: A repeated measures ANOVA was used with Group (confabulating amnesia patients, non-confabulating amnesia patients and healthy controls) as the between participant factor and Word category (positive, negative and neutral) as the with-in participant factor.

Three separate two-way ANOVAs were carried out to examine participants' performance on previously studied target words, critical distracters and unrelated intrusions.

To summarize, the analysis for study 1 consisted of a 3 (Group) x 3 (Word-Category) analysis of variance.

2.7.2. Study Two - Facial Expressions Semantic-Associates Procedure

Rationale: This study aimed to examine the positive emotional bias in confabulation using a pictorial semantic-associates procedure. All three groups of participants from the first study took part in study 2.

Measure: A semantic-associates procedure was constructed using photographs of emotional facial expressions. These photographs were used from Kohler (2003) and comprised facial expressions from 6 emotional categories: anger, disgust, fear, sad, neutral and happy (see Appendix 2.5). Each emotional category consisted of ten photographs of facial expressions. Each photograph was printed on an A5 card and displayed in a booklet. The photographs for all six emotional categories were presented in a single display booklet.

This procedure did not include a recall test as the studied items were presented in the form of pictures. Instead participants were examined on their ability to recognise the pictorial studied items.

The recognition test for this procedure was constructed by displaying six of the previously studied photographs from each emotional category. These photographs were selected from serial positions 1, 3, 5, 6, 8 and 10. For each emotional category, 5 non-studied intrusions and one critical distracter were also included in the recognition test.

Pilot study: A preliminary experiment was conducted for this study in order to produce a non-presented critical distracter for each of the 6 emotional categories. Ten healthy participants were presented with 48 photographs from the 6 emotional categories. Kohler (2003) identified these photographs as expressing one of the 6 emotions with extreme intensity (for example, a photograph expressing extreme happiness). For each emotional category, 8 of the extreme intensity photographs were displayed on a Dell desktop computer screen. Participants were asked to rate the expression on the photographs for each emotional category on a rating scale from 1 (the least expressive of that emotion) and 10 (the most expressive). For each emotional category, the photograph that received the highest rating was selected as the critical distracter (see Appendix 2.6 for pilot data).

<u>Procedure</u>: All three groups of participants were administered the facial expressions semantic-associates procedure in approximately 1 hour while healthy controls completed this procedure in approximately 30 minutes.

Healthy controls were administered studies 1 and 2 in one session. This group completed both studies in approximately 2.5 hours. The confabulating and non-confabulating groups were administered studies 1 and 2 in two separate sessions in order to reduce the risk of burden and fatigue. The two patient groups completed this study in approximately 3 hours.

<u>Analysis</u>: A repeated measure ANOVA was used with Group (confabulating amnesia patients, non-confabulating amnesia patients and healthy controls) as the between participant factor and Word category (happy, sad, fear, disgust, anger and neutral) as the with-in participant factor.

Three separate two-way ANOVAs were carried out to examine participants' recognition performance on target words, critical distracters and unrelated intrusions.

To summarize, the analysis for study 2 consisted of a 3 (Group) x 6 (Word-category) analysis of variance.

2.7.3. Study Three – Mood Induction and the Semantic-Associates Procedure

Rationale: This study aimed to examine the role of mood on the content of confabulation.

Measure: This study aimed to induce participants into positive and negative mood states. Participants were induced into a mood state before the presentation of the semantic–associates procedure in order to investigate the effects of mood on false recall and false recognition. Video mood induction procedures have been previously shown to induce temporary but effective mood states (Smith, 1995; Henry et al., 2009; Kunzmann and Gruhn, 2005). These studies used short films that depicted stories with pleasant or unpleasant emotional content. This procedure was found to be effective in inducing reliable mood states. On this basis, the present research aimed to employ a video mood induction procedure in order to induce each participant into a positive and a negative mood state on two separate occasions. Participants were induced into a positive mood condition using a 7 minute scene from the British comedy series entitled ‘Dad’s Army’. Negative mood was induced using a 10 minute edited scene from a movie entitled ‘One True Thing’. Both videos were presented to participants using an Acer Notebook computer. These videos were used in previous research and were shown to induce emotional responses in both healthy controls and patients with Alzheimer’s disease (Kunzmann and Gruhn, 2005; Mograbi et al., 2012).

Mood Induction Procedure: All three groups of participants were first induced to positive and negative mood states before they performed the affective semantic-associates procedure. Participants were induced into a mood state using a positive and a negative video mood induction procedure. In each group, half of the participants were induced into a positive mood state before performing a semantic-associates procedure in the first session. After approximately two weeks, these participants were invited for a second session where they were induced into a negative mood state before performing another semantic-associate procedure. The other half of the participants were allocated to the two mood conditions in the reverse order.

Participants completed a PANAS questionnaire immediately after the presentation of the video clip.

Mood Induction Pilot study: a preliminary experiment was conducted to examine whether the mood induction procedure induced participants into positive and negative mood states. Four healthy participants were asked to watch one of two video clips. Half of the participants watched the video clip from the positive condition entitled ‘Dad’s Army’, while the other half watched the video clip from the negative condition entitled ‘One True Thing’. Participants were then asked to complete the Positive Affect Negative Affect Scale (PANAS) questionnaire adapted from Watson and Clark (1994) to measure their mood immediately after the clip ended (see Appendix 2.7). After approximately two days, participants who watched the positive video were presented with the negative video. Similarly, participants who watched the negative video were later presented with the positive video clip. This experiment revealed that participants rated their mood as more pleasant after watching the positive video. These participants also rated their mood as more negative after watching the negative video. This suggested that the chosen video clips were reliable in inducing participants into positive and negative mood conditions (see appendix 2.8 for pilot data).

<u>Affective Semantic Associates Procedure:</u> The affective semantic-associates lists used in the first study were employed in the third study. However, 3 more lists were added to make a total of 12 lists of word associates. The 12 study lists comprised 4 positive, 4 negative and 4 neutral word lists. Each list consisted of 15 word associates to one non-presented critical distracter (see Appendix 2.9). Each word was printed on an A5 card and was displayed in a booklet. The lists were divided into Condition 1 and Condition 2 and were presented in a counter-balanced order between the positive and negative mood inductions. For example, a participant who received the word lists from Condition 1 in the positive induction procedure later received the lists from Condition 2 in the negative induction procedure.

A recall test was administered immediately after participants had been presented with each list in the display booklet.

The recognition test was constructed by displaying 24 of the previously studied words. These words were selected from each of the 12 study lists, from serial positions 1, 2, 12 and 15 as outlined above. The recognition test also included 6 critical distracters and 24 non-presented words that were unrelated to the previously studied lists. Each word was printed on an A5 card and was displayed in a booklet. The studied words, critical distracters and unrelated intrusions were all presented in a single display booklet.

Healthy controls were administered study 3 in two separate sessions; the total time taken was approximately 3.5 hours. The confabulating and non-confabulating amnesia groups had three separate sessions, with approximately 5 hours for total completion.

Analysis: A repeated measure ANOVA was used with Group (confabulating amnesia patients, non-confabulating amnesia patients and healthy controls) as the between participant factor. Word-category (positive, negative and neutral) and Mood condition (positive or negative) were the with-in participant factors.

Three separate three-way ANOVAs were carried out to examine participants' performance on target words, critical distracters and unrelated intrusions.

To summarize, the analysis for study 3 consisted of a 3 (Group) x 3 (Word-category) x 2 (Mood condition) analysis of variance.

Chapter 3

Study 1: The Affective Semantic-Associates Procedure

3.1. Introduction

Previous studies have obtained findings showing that there are emotional biases in the content of confabulation. However these findings were often derived from single-case studies (Conway and Tacchi, 1996; Fotopoulou et al., 2004; Solms 2000). Fotopoulou and colleagues' (2008b) work on a prose recall task in confabulating patients is one of the very few studies that have experimentally examined the emotional content of confabulation. The findings from this study suggested that the content of confabulation is often more pleasant than the real memories that they replaced. Fotopoulou and colleagues (2008a) argued that further experimental research is needed to investigate the emotional triggers of confabulation. Therefore, the present study aimed to examine whether there is an emotional bias in the content of confabulation using the semantic-associates paradigm (Roediger et al., 2001). This procedure was used to examine whether confabulating patients show a tendency to produce more positive false memories in comparison with non-confabulating amnesia patients and healthy controls.

In a series of studies, Fotopoulou and colleagues (2004, 2008a, and 2008b) obtained findings showing that confabulating patients distort their previous memories such that they become more emotionally pleasant in contrast to non-confabulating patients and healthy controls. Confabulating patients' often attributed their current memory impairment and other disabilities to their premorbid personality and beliefs. Fotopoulou (2010) argued that these patients' desire to maintain self-coherence is not adequately processed due to executive dysfunction and impaired reality monitoring. A deficit in executive processes may distort the correspondence between memory and reality demands in the sense that current personal goals override the process of memory reconstruction. Consequently, patients produce confabulations that appear more exaggerated than the corresponding reality (Fotopoulou et al., 2010).

Fotopoulou and colleagues (2009) showed that confabulating patients produced more positive self-referent false memories compared with healthy controls. Naïve judges rated patients' confabulations as significantly more positive compared with the patients' true experiences as verified by the patients' designated informant. This finding led Fotopoulou and colleagues to postulate that confabulation serves to maintain a positive self-image. However, the confabulations reported in the current literature are not universally positive and self-enhancing (Metcalf et al., 2010; Bajo et al., 2010). Clinical observations have reported a tendency for patients to produce confabulations related to the death of a close-relative (Metcalf et al., 2010; Gilboa, 2010). This led Metcalf and colleagues (2010) to hypothesise that confabulation reflect a personal bias to recall memories that are related to self-representations in order to maintain self-coherence. These self-representations are related to the individual's past experiences whether pleasant or unpleasant.

To summarise, there is controversy in the current literature about whether there are emotional biases in the content of confabulation. Fotopoulou and colleagues (2008a) argued that the content of confabulation is motivated and wishful.

Conversely, Metcalf and colleagues (2010) opposed this perspective and argued that the content of confabulation is not necessarily self-enhancing as some patients have been shown to produce unpleasant confabulations (Schnider, 2008; Metcalf et al., 2010; Bajo et al., 2010). However, previous studies have consistently used rating systems to analyse the emotional content of confabulation (Turnbull et al., 2004; Fotopoulou et al., 2008a; Bajo et al., 2010). This method relies on naïve judges to rate the emotional valence of the confabulation. Several studies have shown biases in judgement and decision making which can influence the naïve judges' ratings and sometimes lead to inaccurate results (Kerr et al., 1996; Robert, 1998; Hilbert, 2012).

The present research is the first to use the semantic-associates procedure to examine the emotional content of confabulation. This procedure, developed by Deese (1959), is well-established for inducing false recall and false recognition in healthy participants through the presentation of lists of words related to non-presented critical distracters (Roediger and McDermott, 1995). For example, the critical distracter 'butterfly' formed this list of associates: moth, insect, wing, bird, fly, yellow, net, pretty, flower, bug, cocoon and colour. Findings using this procedure showed that healthy participants tended to falsely recall and falsely recognise a critical distracter in response to its association to the studied words on the list (Deese, 1959; Roediger and McDermott, 1995). The semantic-associates procedure was subsequently employed to examine false recall and false recognition in patients with severe memory disorders.

Schacter and colleagues (1998) examined false recognition in non-confabulating amnesic patients using the semantic-associates procedure.

Results from this study showed that non-confabulating amnesic patients falsely recognised a *lower* proportion of critical distracters compared with healthy controls. Furthermore, these patients falsely recognised *more* unrelated intrusions than critical distracters. The finding that non-confabulating amnesic patients show a low rate of false recognition to critical distracters was replicated by further studies using the semantic-associates procedure (Melo et al., 1999; Ciaramelli et al., 2006; Koutstaal et al., 2001). Schacter and colleagues (2002) suggested that non-confabulating amnesic patients' tendency to show reduced false recognition to critical distracters but increase false recognition to unrelated intrusions may be due to degraded gist memory. Critical distracters elicit a strong sense of familiarity in healthy participants because these non-presented words fit the theme of the studied list. It is postulated that amnesic patients retain limited gist information and are less likely to falsely recognise critical distracters compared with healthy controls. However, this theory has been based on findings from non-confabulating amnesic patients and has not been applied to explain false recognition in confabulating amnesic patients.

Melo and colleagues (1999) conducted a study of patients with frontal lobe lesions that consisted of both confabulating and non-confabulating patients. Therefore, this study did not investigate the systematic differences in false recognition between confabulating and non-confabulating patients. Despite this, Melo and colleagues found that the majority of patients with lesions in the medial temporal lobes and frontal lobes showed *reduced* false recognition to critical distracters, but *increased* levels of false recognition to unrelated intrusions. This pattern was observed in both confabulating and non-confabulating patients. Therefore this study suggested that some confabulating patients with frontal lobe lesions show reduced false recognition to critical distracters.

Subsequently, Ciaramelli and colleagues (2006) examined systematic differences in false recall and false recognition between 5 confabulating amnesia patients and 9 non-confabulating amnesia patients using the semantic-associates procedure. Findings showed that both the confabulating and non-confabulating amnesia patients falsely recognised a lower proportion of critical distracters compared with healthy controls. There were no significant differences between the two amnesia groups on the rate of false recognition to critical distracters. However, the confabulating group falsely recognised a significantly *higher* proportion of unrelated intrusions compared with the non-confabulating group.

To date, the semantic-associates paradigm has not been used to examine emotional biases in the content of confabulation. Therefore, this procedure was modified in the present study by using lists of negative, positive and neutral words from Roediger and colleagues (2001). The present study addressed the following aims:

- To investigate whether confabulating and non-confabulating amnesia patients recall and recognise a lower proportion of target words compared with healthy controls.

- To investigate whether confabulating and non-confabulating amnesia patients falsely recall and falsely recognise a lower proportion of critical distracters compared with healthy controls.

- To investigate whether confabulating amnesia patients show a bias to falsely recall and falsely recognise more positive unrelated intrusions compared with non-confabulating amnesia patients and healthy controls.

- To investigate whether confabulating amnesia patients show a bias to falsely recall and falsely recognise more positive unrelated intrusions compared with negative and neutral intrusions.

3.2. Method

The method section of chapter three will begin by discussing the participants' demographic and clinical diagnoses. The chosen background neuropsychological tests used in this study will then be briefly summarised. In the later part of this method section, the experimental procedure for this study will be outlined.

3.2.1. Participants

This study comprised three groups of participants: 13 confabulating amnesia patients, 13 non-confabulating amnesia patients and 13 healthy controls. All participants that were recruited for this study also took part in study 2 (chapter 4).

The recruitment criteria for the present research are briefly summarised below. A more detailed description of the inclusion and exclusion criteria has been presented in the previous chapter.

Patients who were clinically diagnosed with amnesia were approached for this study. Confabulating patients were recruited if they were clinically identified as producing confabulatory responses. Patients allocated to the confabulating amnesia group had to also score 8 or more on the episodic section of the Dalla Barba confabulation battery. In contrast, non-confabulating patients were recruited if they were diagnosed with amnesia in the absence of confabulatory behaviour. These patients had to also score 4 or less on the episodic section of the Dalla Barba confabulation battery (Bajo et al., 2010).

<u>Matching Variables</u>

The non-confabulating group and healthy controls were recruited on the basis that they matched the confabulating group on demographic variables (i.e.: age, gender and level of education). Measures were also taken to ensure that there were no significant differences between the confabulating and non-confabulating groups for the severity of amnesia. These measures are described below:

<u>Participants Demographic Differences</u>

Statistical analyses were employed to examine differences between the three groups of participants based on gender, age and level of education.

Table 3.1 (below) shows the mean percentage of males and females in each of the three groups. The table also shows the means and standard deviations for age and level of education.

A chi-square test for independence (with Fisher's Exact Test) was used to analyse group differences on gender. This test showed no significant difference between the groups: x^2 (2, n= 39) = .92, *p* = .76.

A one-way ANOVA was conducted to analyse differences between the three groups based on age and level of education. Findings showed that there were no statistically significant age differences between the groups (*F* (2, 36) = 2.63, *p* = .09) and level of education (*F* (2, 36) = 1.75, *p* = .19).

Table 3.1: Demographic difference: The mean (SD) and significant differences on age and gender between the three participant groups: 13 confabulating patients, 13 non-confabulating patients and 13 healthy controls.

	Confabulating Group	Non-confabulating Group	Healthy Controls
Gender			
% Male	69.2%	69.2%	53.8%
% Female	30.8%	30.8%	46.2%
Age			
Means (SD)	56.08 (14.03)	55.46 (9.51)	45.00 (16.93)
Level of Education			
Means (SD)	13.23 (1.42)	13.69 (1.03)	14.38 (2.10)

Participants standard deviation differences based on the WMS-IV subtests

Table 3.2 (below) shows mean raw scores and z scores on the Wechsler Memory Scale-IV immediate subtests (WMS-IV, Wechsler, 1998) across the current sample of confabulating and non-confabulating amnesia patients. This table shows the differences between the z scores for the WMS-IV memory tests and z scores for current (WASI) IQ. Patients were recruited on the basis that their score on each memory test is a minimum of 1.5 standard deviations below their current measured IQ.

Table 3.2: Matching variables: Differences between confabulating and non-confabulating patients' current intellectual functioning and memory performance.

WMS-IV (Immediate Subtests)	Confabulating Group		Non-confabulating Group		Z Score Differences (t-test results)
	Mean Raw scores	Z Scores Corrected for IQ	Mean Raw Scores	Z Scores Corrected for IQ	t- value, df (24)
Logical Memory	9.6	-2.5	14.1	-2.2	-1.15
Verbal Paired Associates	4.3	-2.4	8.5	-2.4	-0.21
Visual Reproduction	15.0	-2.5	23.9	-2.0	-1.99

A score of more than 1.5 standard deviations below current WASI IQ on the Wechsler memory subtests indicated an amnesic syndrome. Table 3.2 shows that the two amnesia groups performed markedly worse on the memory subtests than this cut-off score. An independent-samples t-test shows that there were no significant differences between the two groups on z scores (see Table 3.2 for t-test results). This suggests that there were no significant difference between the two patient groups for the severity of amnesia. Although there were no significant differences between the two amnesia groups on IQ corrected visual reproduction, the confabulating group had a significantly lower raw score on this test in comparison with the non-confabulating group (see Table 3.4).

Participants' Clinical Diagnoses

Amnesia is a memory disorder that occurs in the context of differing clinical diagnoses and underlying pathologies. On this basis, the confabulating and non-confabulating amnesia patients in the present research were grouped according to their clinical diagnoses. Table 3.3 shows the clinical diagnoses that the patients were given at the time of recruitment.

Clinical Diagnoses in the Confabulating Group

The confabulating patients that were recruited for this research were often diagnosed with Wernicke-Korsakoff syndrome (7/13). Traumatic brain injury was also common in this group and was often the result of vehicle accidents and falls (4/13). One confabulating patient had been diagnosed with cerebrovascular disease caused by hypertension. There was also one case of HIV encephalopathy in the current sample of confabulating patients.

Clinical Diagnoses in the Non-confabulating Group

Similar to the confabulating group, Wernicke-Korsakoff syndrome was the most common diagnosis in the current sample of non-confabulating amnesia patients (5/13). However, traumatic brain injury was not observed in this group. Cerebrovascular disease was more common in the non-confabulating group and was caused by hypertension (3/13). Epilepsy in this group was the result of seizures arising from the temporal lobe region (3/13). Only one non-confabulating patient had been diagnosed with HIV encephalopathy. Limbic Encephalitis had been diagnosed in one patient.

Table 3.3 Clinical Diagnoses: 13 confabulating amnesia patients and 13 non-confabulating amnesia patients were grouped according to their clinical diagnoses at the time of recruitment.

Diagnostic Group	Confabulating Group	Non-confabulating Group	Total
	N=13	N=13	N=26
Traumatic Brain Injury	4 (30.8%)	0 (0%)	4 (15.4%)
Wernicke-Korsakoff Syndrome	7 (53.8%)	5 (38.5%)	12 (46.2%)
Cerebrovascular Disease	1 (7.7%)	3 (23.1%)	4 (15.4%)
HIV Encephalopathy	1 (7.7%)	1 (7.7%)	2 (7.7%)
Temporal Lobe Epilepsy	0 (0%)	3 (23.1%)	3 (11.5%)
Limbic Encephalitis	0 (0%)	1 (7.7%)	1 (3.8%)

3.2.2. Neuropsychological Measures

Background neuropsychological tests were chosen to characterise the patterns of cognitive function and impairment in each participant. The neuropsychological tests used in the present research are summarized below.

- National Adult Reading Test-Revised (NART-R) (Nelson and Willison, 1991): This measure was used to estimate premorbid intellectual functioning.

- Wechsler Abbreviated Scale of Intelligence 2-subtests (WASI) (Wechsler, 1999): The Vocabulary and Matrix Reasoning subtests were used to estimate current intellectual ability.

- Wechsler Memory Scale-IV immediate subtests (WMS-IV) (Wechsler, 1998): Logical Memory, Verbal Paired Associates and Visual Reproduction subtests were used to measure anterograde verbal and non-verbal recall memory.

- Recognition Memory Test (RMT; Warrington, 1984): This test was used to measure both verbal and nonverbal recognition memory.

- Hayling and Brixton Tests (Burgess and Shallice, 1997): These tests were used to measure executive functioning.

3.2.3. The Affective Semantic-Associates Procedure

The materials used to construct the affective semantic-associates procedure were described in the previous chapter. The affective semantic-associates procedure was administered in the following order:

1. Study Phase - Participants were presented with 9 lists of words. Each list contained 15 word associates of one non-presented critical distracter (see Appendix 2.4). Each word was printed on a single page inside an A5 display booklet. The participants were asked to study each presented word. The researcher presented each word for three seconds before turning the page

to display the next word. Each display booklet contained three word-lists belonging to one of the following categories: positive, negative and neutral.

2. Free Recall Test – A free recall test was administered immediately after the presentation of each list. Once participants had completed the recall test for all nine lists, they were then administered the recognition test.

3. Recognition Test - Participants were presented with a single display booklet containing 36 previously studied words. The booklet also included 36 new non-presented words that were unrelated to the lists and 9 critical distracters that had not been previously studied, but were related to the words presented in the study phase. Participants were asked whether they had previously been presented with each word in the study phase of the experiment and to respond with either ‘yes’ or ‘no’.

3.3. Results

This section will begin with a discussion of the results for each neuropsychological test administered to the three groups of participants. This is followed by a discussion of the results obtained from the confabulation interview. In the later part of this section, the results obtained from the semantic-associates procedure will be discussed.

3.3.1. Neuropsychological results

The neuropsychological data were statistically analysed using one-way ANOVA in order to compare the three groups. In addition, independent-samples t-tests were used to compare the confabulating and non-confabulating groups on memory and executive measures.

Table 3.4 (below) shows the means, standard deviations and percentile scores of the three groups on the neuropsychological tests. This is followed by a description of the findings on participants' performance on each neuropsychological measure.

Table 3.4: <u>Neuropsychological Results:</u> Mean raw scores, standard deviations and percentile scores on neuropsychological tests between 13 confabulating amnesia patients and 13 non-confabulating amnesia patients and 13 healthy controls.

Neuropsychological Tests	Confabulating Group		Non-confabulating Group		Healthy Controls	
	Mean (SD)	%ile	Mean (SD)	%ile	Mean (SD)	%ile
NART Full Scale IQ	101.5 (10.2)	53rd	106.5 (6.8)	66th	105.8 (8.3)	63rd
WASI (2-subtests)						
Vocabulary	55.7 (10.6)	50th	57.7 (9.0)	63rd	58.8 (5.8)	63rd
Matrix Reasoning	18.6 (3.7)	50th	24.9 (9.4)	75th	25.6 (6.0)	75th
WASI Full Scale IQ	98.2 (11.68)	45th	105.5 (11.4)	63rd	108.1(8.1)	70th
WMS IV (immediate subtests)						
Logical Memory	9.6 (4.6)	1st	14.1 (6.9)	5th	30.1 (3.4)	75th
Verbal Paired Associates	4.3 (4.8)	1st	8.5 (6.9)	2nd	39.2 (10.9)	75th
Visual Reproduction	15.0 (7.7)	1st	23.9 (6.2)	5th	41.3 (1.6)	91st
RMT						
Word Recognition	29.3 (5.4)	1st	35.8 (4.9)	5th	47.8 (2.6)	75th
Face Recognition	28.0 (3.7)	1st	35.3 (4.7)	5th	41.8 (4.4)	25th
Hayling Test						
Sentence Completion (Time)	27.9 (13.6)	5th	18.4 (7.7)	25th	16.2 (10.3)	25th
Unconnected Completion (Time)	57.7 (10.8)	25th	48.6 (11.8)	50th	27.5 (15.9)	50th
Unconnected Completion (Error)	15.0 (3.2)	5th	13.2 (9.0)	10th	2.2 (2.7)	75th
Brixton Test						
Error Score	26.7 (5.8)	1st	18.0 (3.5)	25th	14.8 (3.5)	50th

Premorbid and Current Intellectual Ability

The NART-R and WASI tests were used in the present research to measure participants premorbid and current intellectual functioning. An inspection of the means on these tests suggested that both patient groups' current intellectual ability was mildly deteriorated compared with their estimated premorbid cognitive functioning. However, an analysis of these results using one-way ANOVA showed no statistical differences between the three groups on the NART-R (F (2, 36) = 1.29, p = .29) and WASI IQ (F (2, 36) = 3.11, p = .06).

Anterograde Memory

The WMS-IV and RMT were used to examine participants' verbal and non-verbal recall and recognition memory abilities. An inspection of the percentile scores on Table 3.4 indicated that both patient groups were markedly impaired in terms of remembering verbal and non-verbal information. One-way ANOVA showed that there were significant differences between the three groups on all three WMS–IV immediate subtests: logical memory (F (2, 36) = 56.74, p<.01), verbal paired associates (F (2, 36) = 74.69, p <.001) and visual reproduction (F (2, 36) = 76.45, p<.001). Further analysis using Tukey post-hoc test indicated that the confabulating group significantly underperformed on all three subtests compared with the healthy controls (p<.001). However there were no significant differences between the two amnesia groups on the logical memory subtest (mean difference = 4.46, p = .08) and the verbal paired associates subtest (mean difference = 4.23, p = .37). However, the Tukey test also indicated that there were significant differences between the confabulating and non-confabulating groups on the immediate visual reproduction subtest (mean difference = 8.92, p<.001). There were no significant differences between the two amnesia groups when their visual reproduction scores were corrected for IQ (see Table 3.2). On the RMT tests, a Tukey post-hoc analysis indicated that the confabulating group significantly underperformed compared with the healthy controls ($p<.01$). In addition, the confabulating group recognised a significantly lower proportion of words and faces on the RMT tests compared with the non-confabulating group ($p<.01$). This suggested that the confabulating group were more impaired on visual and verbal recognition compared with the non-confabulating group.

Executive Functioning

The Hayling and Brixton tests were used to measure participants' executive abilities. The mean scores on Table 3.4 show that the confabulating group markedly underperformed on executive measures. There were significant differences between the three groups on the Hayling sentence completion test: F (2, 36) = 4.24, $p<.05$. Further analysis using Tukey post hoc test indicated that the confabulating group significantly underperformed on this test compared with the healthy controls: mean difference = 11.62, $p<.05$. However, no significant differences were found between the two amnesia groups: mean difference = 9.46, p = .08. Furthermore, there were significant differences between the three groups on the Hayling unconnected completion time scores: F (2, 36) = 18.38, $p<.001$. The confabulating patients had more difficulties initiating a well-timed response compared with healthy controls: mean difference = 30.15, $p<.001$. However, there were no significant differences between the two amnesia groups on this test: mean difference = 9.08, p = .19. There were significant differences between the three groups on the Hayling unconnected completion error scores: F (2, 36) = 18.38, $p<.001$. Furthermore, both the confabulating and non-confabulating groups produced more errors on this test compared with healthy controls ($p<.001$). However, there were no significant differences between the confabulating and non-confabulating groups on this test: mean difference = 1.85, p = .69. These findings showed that both amnesia groups were slower to respond yet produced more errors than the healthy controls.

On the Brixton test, there were significant differences between the three groups: F (2, 36) = 25.90, $p<.001$. Further analysis using Tukey post hoc test revealed that the confabulating group had more difficulties identifying and following a rule compared with the two comparison groups: non-confabulating group: mean difference = 8.69, p<.001 and healthy controls: mean difference = 11.93, p<.001.

3.3.2. Confabulation results

Table 3.5 (below) shows the mean proportion of confabulatory responses produced in response to the following sections of the Dalla Barba interview: personal semantic, episodic, general semantic, general episodic and orientation questions. The results were calculated by obtaining the mean proportion of confabulatory answers produced in response to each section of the Dalla Barba interview. These results were analysed using proportions as the total number of questions varied in each section of the interview.

Table 3.5: Confabulation Results: Proportion of confabulatory answers in each section of the questionnaire expressed as means and standard deviations for the confabulating and non-confabulating groups.

Dalla Barba Confabulation Battery - UK Edition	Confabulating Group		Non-confabulating Group		Statistical Differences Between Groups
	Mean	SD	Mean	SD	t-test results
Confabulatory responses on personal semantic questions	.20	.18	.02	.03	*t* (12.8) = 3.63, *p*< .01
Confabulatory response on episodic questions	.59	.06	.01	.03	*t* (24) = 31.46, *p*< .001
Confabulatory responses on orientation questions	.24	.21	.02	.04	*t* (24) = 3.77, *p*< .01
Confabulatory responses on general semantic questions	.17	.12	.03	.06	*t* (17.2) = 3.66, *p*<.01
Confabulatory responses on 'I don't-know' semantic questions	.29	.17	.08	.12	*t* (24) = 3.72, p< .01
Confabulatory responses on 'I don't-know' episodic questions	.17	.11	.01	.03	*t* (14.9) = 5.09, p< .01
Proportion of confabulations in the total questionnaire	.28	.07	.02	.02	*t* (14.9) = 13.05, *p*< .001

Table 3.5 shows that the confabulating group produced more confabulatory answers compared with the non-confabulating group during the whole interview. This is confirmed by an independent-samples t-test which shows significant differences between the two groups in the total proportion of confabulatory responses produced on this measure.

In addition, the independent-samples t-test shows that the confabulating group produced a significantly higher proportion of confabulatory answers compared with the non-confabulating group on personal semantic questions, episodic questions and general semantic questions. The confabulating group were also more disorientated in time and place compared with the non-confabulating group.

The independent-samples t-test also shows that the confabulating group produced a significantly higher proportion of confabulatory answers compared with the non-confabulating group on both semantic and episodic “I-don’t-know” questions.

3.3.3. Experimental Results

Free recall and recognition results obtained from the affective semantic-associates procedure were analysed for all three groups.

Three separate repeated measures ANOVAs were conducted to analyse the three dependent variables: target words, critical distracters and unrelated intrusions. This method was carried out for the recall and recognition tests. The results for the recall test are described below. This is followed by the results for the recognition test.

3.3.3.1. Recall Results

Table 3.6 shows the mean proportion of target words correctly recalled from the three word categories (positive, negative and neutral). The table also shows the mean proportion of critical distracters and unrelated intrusions falsely recalled from the three word categories between the three groups of participants.

Table 3.6: Recall Results: Mean scores (SD) for the proportion of target words, critical distracters and unrelated intrusions produced in the recall test between the three groups of participants.

Recall Test Results	Confabulating Group	Non-confabulating Group	Healthy Controls
	Mean (SD)	Mean (SD)	Mean (SD)
Proportion of Target Words :			
Positive Target Words	.19 (.05)	.26 (.04)	.52 (.09)
Negative Target Words	.18 (.06)	.27 (.05)	.50 (.08)
Neutral Target Words	.17 (.05)	.25 (.05)	.46 (.07)
Proportion of Critical Distracters:			
Positive Critical Distracters	.05 (.12)	.08 (.14)	.28 (.23)
Negative Critical Distracters	.05 (.12)	.05 (.12)	.18 (.17)
Neutral Critical Distracters	.03 (.09)	.03 (.09)	.15 (.22)
Proportion of Unrelated Intrusions:			
Positive Unrelated Intrusions	.10 (.16)	.05 (.12)	.05 (.12)
Negative Unrelated Intrusions	.08 (.14)	.08 (.14)	.08 (.14)
Neutral Unrelated Intrusions	.08 (.14)	.10 (.16)	.05 (.12)

Recall Test Results for Target Words

A repeated measures ANOVA was used to examine the proportion of target words recalled from three word categories (positive, negative and neutral) between three groups (confabulating group, non-confabulating group and healthy controls). Results from this test showed a significant main effect of Group: F (2, 36) = 159.39, p<.001 and Word-Category: F (2, 72) = 4.11, p<.05. However there was no significant interaction between Group and Word-Category: F (4, 72) = .60, p= .66. This suggested that there is a significant difference in the proportion of targets correctly recalled between the three groups. These findings also suggested that there were overall differences in terms of the proportion of targets recalled across the word categories. However, there were no group differences in the proportion of targets recalled across the word categories.

Tukey post-hoc analyses were also carried out to explore the significant main effect of Group using one-way ANOVA. This test showed that the confabulating group recalled a significantly lower proportion of target words compared with the two comparison groups: non-confabulating group (mean difference = .08, p<.001) and healthy controls (mean difference = .31, p<.001). The non-confabulating group also recalled a significantly lower proportion of target words compared with healthy controls (mean difference = .23, p<.001). These findings indicated that the confabulating group was more impaired on recall compared with the non-confabulating group. Nevertheless, the non-confabulating group significantly underperformed on the recall of target words compared with the healthy controls.

Paired-sample t-tests were then carried out to explore the significant main effect of Word-Category. Findings showed that overall participants recalled a higher proportion of positive and negative target words compared with the neutral words: positive targets (t (38) = 3.05, p<.01) and negative targets (t (38) = 2.02, p=.05). However there were no significant differences between the proportion of positive and negative targets recalled: t (38) = .71, p= .49. The results indicated that generally affective information may be easier to retrieve compared with non-emotional information.

Recall Test – Results for Critical Distracters

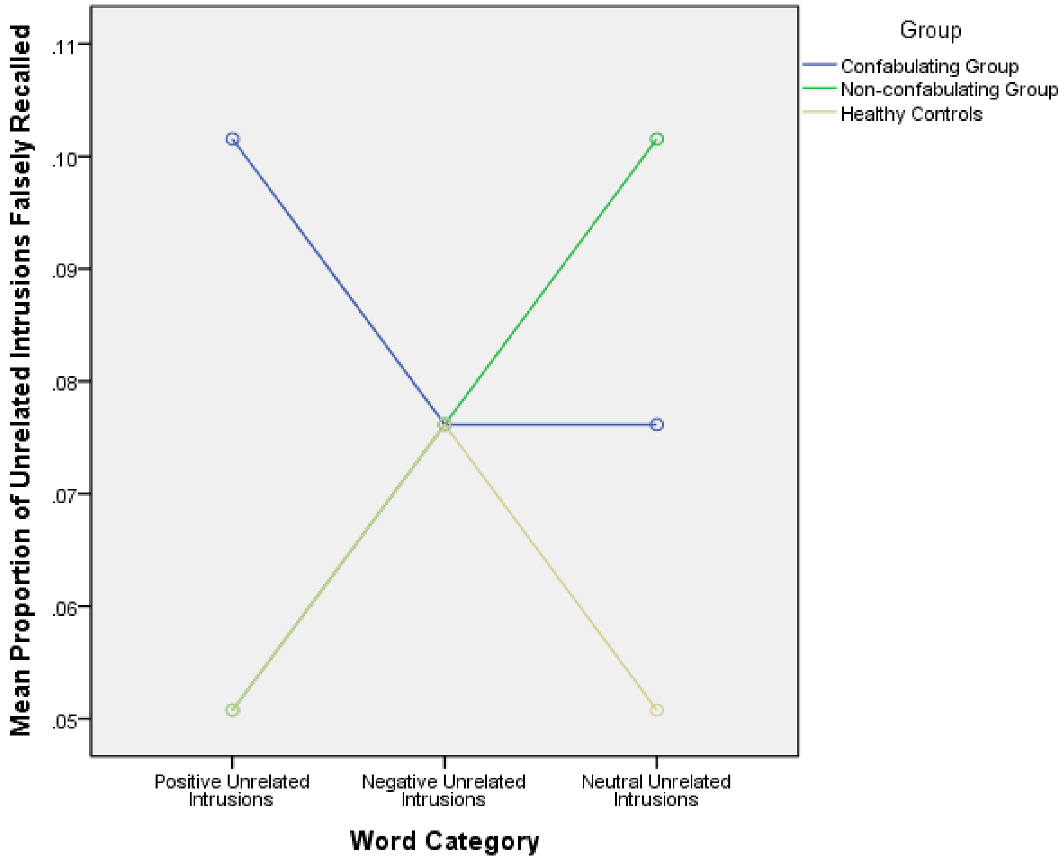
A repeated measures ANOVA was conducted to examine the proportion of critical distracters recalled from three word categories (positive, negative and neutral) between the three groups of participants (confabulating group, non-confabulating group and healthy controls). There was a significant main effect of Group: F (2, 36) = 13.17, p<.001. Maulchy's test showed that the assumption of sphericity had been violated for the main effect of Word-Category ($x^2(2)$ =1.96, p=.15). The degrees of freedom were then corrected using Greenhouse-Geisser estimates (ε =.86). Furthermore, there was no significant interaction between Group and Word-Category: F (4, 72) = .53, p= .72. These findings indicated that there were differences in the proportion of critical distracters falsely recalled between the groups, but not across the three word categories.

The significant main effect of Group was further examined using a Tukey post hoc test. This analysis revealed that the two amnesia groups recalled a significantly lower proportion of critical distracters compared with the healthy controls: confabulating group (mean difference = .16, p<.001) and non-confabulating group (mean-difference = .15, $p<.001$). There was no significant difference between the confabulating and non-confabulating groups on the proportion of critical distracters recalled (mean difference = .01, $p= .98$). Therefore, the confabulating and non-confabulating groups both showed reduced false recognition of critical distracters compared with healthy controls.

Recall Test – Results for Unrelated Intrusions

Figure 3.1 reflects insignificant weak trends which show that the confabulating group falsely recalled a higher proportion of positive unrelated intrusions compared with negative and neutral intrusions. This figure also shows that the confabulating group falsely recalled a higher proportion of positive intrusions compared with non-confabulating patients and healthy controls.

Figure 3.1: False Recall of Unrelated Intrusions: Mean proportion of unrelated intrusions from the positive, negative and neutral categories falsely recognised by the three groups of participants: 13 confabulating amnesia patients, 13 non-confabulating amnesia patients and 13 healthy controls.



A repeated measures ANOVA was conducted to examine the proportion of unrelated intrusions recalled from three word categories (positive, negative and neutral) between three groups of participants (confabulating group, non-confabulating group and healthy controls). Results from this test showed that there was no significant main effect of Group *F* (2, 36) = .23, *p*= .80. There was no significant main effect of Word-Category *F* (2, 72) = .06, *p*= .94.There was also no significant interaction between Group and Word-Category: *F* (4, 72) = .41, *p*= .80. These results suggested that there were no significant differences between the three groups in terms of the proportion of unrelated intrusions falsely recalled across the word categories.

Summary of Recall Results

Findings showed that the confabulating group had more difficulties recalling previously studied words compared with non-confabulating patients and healthy controls. Findings also showed that both confabulating and non-confabulating patients falsely recalled a significantly lower proportion of critical distracters compared with healthy controls. Furthermore, no significant differences were observed between the three groups on the false recall of unrelated intrusions.

3.3.3.2. Recognition Test Results

Table 3.7 (below) shows the mean proportion of target words correctly recognised from the three word categories (positive, negative and neutral). The table also shows the mean proportion of critical distracters and unrelated intrusions falsely recognised from the three word categories between the three groups of participants.

Table 3.7: Recognition Results: Mean scores (standard deviations) for the proportion of target words, critical distracters and unrelated intrusions produced in the recognition test between the three participant groups.

Recognition Test Results	Confabulating Group	Non-confabulating Group	Healthy Controls
	Mean (SD)	Mean (SD)	Mean (SD)
Proportion of Target Words :			
Positive Target Words	.53 (.11)	.65 (.12)	.83 (.12)
Negative Target Words	.57 (.12)	.63 (.15)	.79 (.14)
Neutral Target Words	.45 (.12)	.56 (.16)	.76 (.17)
Proportion of Critical Distracters:			
Positive Critical Distracters	.33 (.27)	.41 (.24)	.62 (.33)
Negative Critical Distracters	.36 (.25)	.33 (.33)	.64 (.29)
Neutral Critical Distracters	.26 (.24)	.20 (.22)	.41 (.34)
Proportion of Unrelated Intrusions:			
Positive Unrelated Intrusions	.33 (.22)	.15 (.09)	.06 (.06)
Negative Unrelated Intrusions	.13 (.16)	.15 (.10)	.08 (.11)
Neutral Unrelated Intrusions	.19 (.17)	.22 (.13)	.10 (.11)

Recognition Test - Results for Target Words

A repeated measures ANOVA was used to examine the proportion of target words recognised from three word categories (positive, negative and neutral) between the three groups (confabulating group, non-confabulating group and healthy controls). Results on this test showed that there was a significant main effect of Group: F (2, 36) = 32.57, p<.001 and a main effect of Word-Category: F (2, 72) = 4.90, p<.05. However, there was no significant interaction between

Group and Word-Category: F (4, 72) = .53, p= .71. These findings suggested that there were significant differences between the three groups in terms of the proportion of targets correctly recognised. However, the groups did not differ in terms of the types of words recognised across the three word categories.

The significant main effect of Group was further explored using a Tukey post-hoc analysis. This indicated that the confabulating group recognised a lower proportion of target words compared with the two comparison groups: non-confabulating group (mean difference = .09, p<.05) and healthy controls (mean difference = .27, p<.001).The non-confabulating group falsely recognised a lower proportion of target words compared with healthy controls (mean difference = .18, p<.001). These findings are consistent with the results from the recall test and indicated that the confabulating group had more difficulties recognising previously studied words compared with the two comparison groups. In addition, the non-confabulating group were more impaired on recognition compared with healthy controls.

Paired-sample t-tests were then carried out to analyse the main effect of Word-Category. This test showed that overall participants recognised a significantly higher proportion of target words from the two emotional categories compared with the neutral category: positive targets (t (38) =3.29, p<.01) and negative targets (t (38) = 2.36, p<.05). However there were no significant differences between the proportion of positive and negative targets recognised: t (38) = .23, p= .82. These findings are consistent with the recall results and suggested that affective information may be less susceptible to forgetting and more likely to be retrieved.

Recognition Test - Results for Critical Distracters

A repeated measures ANOVA was conducted to examine the proportion of critical distracters recognised from three word categories (positive, negative and neutral) between the three groups of participants (confabulating group, non-confabulating group and healthy controls). Findings showed that there was a main effect of Group: F (2, 36) = 4.60, p<.05. There was also a significant main effect of Word-Category: F (2, 72) = 8.45, p<.01. However, there was no significant interaction between Group and Word-Category: F (4, 72) = .76, p=.56. These findings indicated a significant difference in terms of the proportion of critical distracters falsely recognised between the groups. The findings also suggested that there were overall differences in terms of the proportion of critical distracters recognised across the word categories. However, there were no differences between the three groups in terms of the proportion of critical distracters falsely recognised across the word categories.

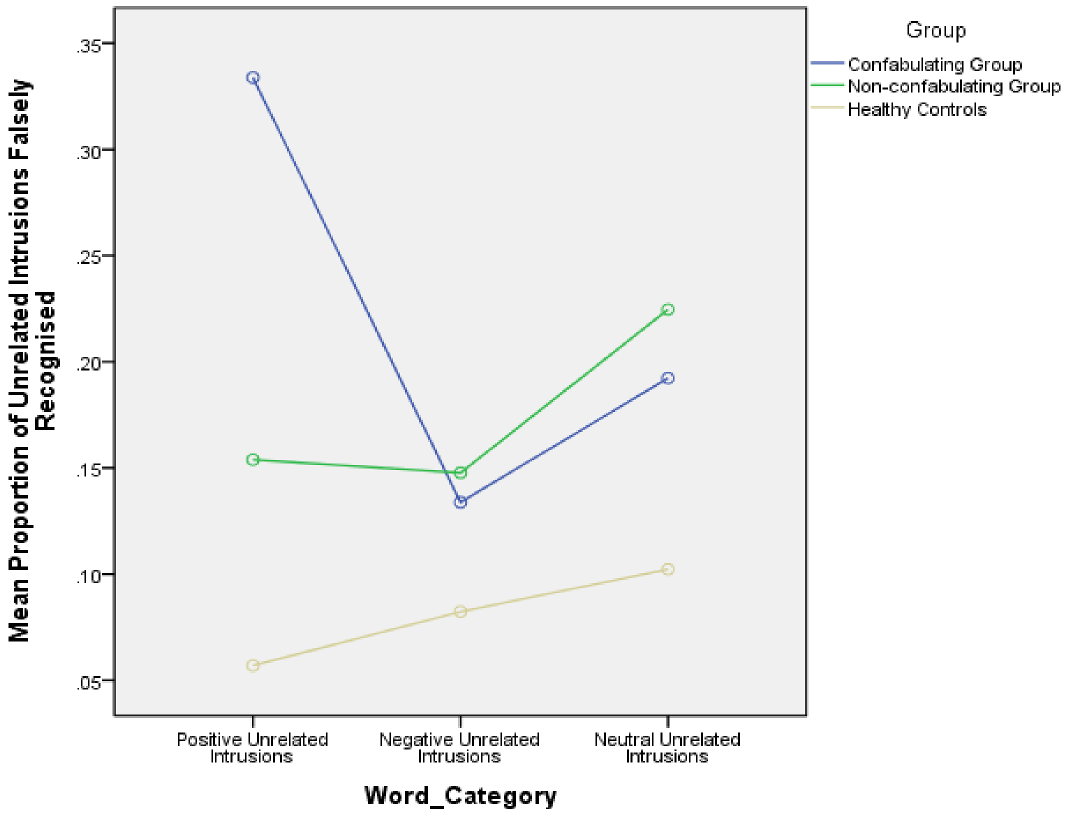
A Tukey post hoc test was used to explore the significant main effect of Group. This showed that the two amnesia groups recognised a significantly lower proportion of critical distracters compared with healthy controls (mean difference = .24, p<.05). There was no significant difference between the confabulating and non-confabulating groups on the proportion of critical distracters falsely recognised (mean difference = .00, p= 1.00). These findings are consistent with the results from the recall test and indicated that both the confabulating and non-confabulating patients showed reduced false recognition of critical distracters compared with healthy controls.

Paired-sample t-tests showed that participants falsely recognised a significantly higher proportion of critical distracters from the two emotional categories compared with the neutral category: positive critical distracters (t (38) = 3.70, p<.01), and negative critical distracters (t (38) = 3.17, p<.01). However there were no significant differences between the proportion of positive and negative critical distracters falsely recognised: t (38) = .21, p= .84.

<u>Recognition Test - Results for Unrelated Intrusions</u>

Figure 3.2 illustrates that the confabulating group produced a high proportion of positive unrelated intrusions in the recognition test compared with unrelated intrusions from the other word categories (negative and neutral). This figure also shows that the confabulating group falsely recognised a higher proportion of positive intrusions compared with non-confabulating patients and healthy controls.

Figure 3.2: False Recognition of Unrelated Intrusions: Mean proportion of unrelated intrusions from the positive, negative and neutral categories falsely recognised by the three groups of participants: 13 confabulating amnesia patients, 13 non-confabulating amnesia patients and 13 healthy controls.



A repeated measures ANOVA was conducted to examine the proportion of unrelated intrusions falsely recognised from three word categories (positive, negative and neutral) between the three groups of participants (confabulating group, non-confabulating group and healthy controls). Findings showed a significant main effect of Group: F (2, 36) = 10.91, p<.001. There was no significant main effect of Word-Category: F (2, 72) = 2.26, p=.12. However, there was a significant interaction between Group and Word-Category: F (4, 70) = 3.39, p<.05. These findings indicated that the groups differed in terms of the proportion of unrelated intrusions falsely recognised across the word categories.

A Tukey post hoc test was used to explore the significant main effect of Group. Findings showed that the two amnesia groups falsely recognised a higher proportion of unrelated intrusions compared with healthy controls: confabulating group (mean difference= .14, $p<.001$) and non-confabulating group (mean difference=.09, $p<.01$). However, there were no significant differences between the confabulating and non-confabulating groups in terms of the proportion of unrelated intrusions falsely recognised (mean difference=.04, $p=.33$). These findings indicated that the confabulating and non-confabulating groups showed a higher rate of false recognition for unrelated intrusions compared with healthy controls.

The significant interaction effect was further examined using the same analysis as above. Results showed no significant differences between the three groups in terms of the proportion of negative and neutral unrelated intrusions. A Tukey post hoc test indicated that the confabulating group falsely recognised a significantly higher proportion of positive unrelated intrusions compared with the two comparison groups: non-confabulating group (mean difference = .18, $p<.01$) and healthy controls (mean difference = .28, $p<.001$). There were no significant differences between the non-confabulating group and healthy controls in terms of the proportion of positive intrusions falsely recognised (mean difference = .10, $p = .20$). These findings indicated that the confabulating group showed a positive bias in the false recognition of unrelated intrusions.

<u>Summary of Recognition Results</u>

Results from the recognition of target words were consistent with the findings obtained from the recall test. This showed that the confabulating group correctly recognised a significantly lower proportion of targets compared with the non-confabulating group and healthy controls. Findings also showed that the confabulating and non-confabulating groups falsely recognised a lower proportion of critical distracters compared with healthy controls. There were no significant differences between the two amnesia groups in terms of the proportion of critical distracters falsely recognised. In contrast to the results from the equivalent recall test, findings showed that both the confabulating and non-confabulating groups falsely recognised a higher proportion of unrelated intrusions compared with healthy controls. In addition, the confabulating group falsely recognised a higher proportion of positive unrelated intrusions compared with the non-confabulating group and healthy controls. The confabulating group also falsely recognised a higher proportion of positive unrelated intrusions compared with negative and neutral intrusions. This positive bias was not found in the non-confabulating group and healthy controls.

<u>Signal Detection Analyses</u>

Signal detection analyses were carried out using rates of endorsement of target words (hit rate) with rates of selection of unrelated intrusions (false alarms) for each of the three word categories (positive, negative and neutral). A standard correction was first carried out on any hit rates of 1.0 or false alarm rates of 0, as recommended by Wixted and Lee (2012). The signal detection analysis provided measures of memory strength (d prime) and response bias (B_D"). Higher values of d prime indicate greater memory strength and higher values of B_D" indicate a conservative response criterion (Brophy, 1986; Donaldson, 1993). A one-way ANOVA was used to examine significant differences between the three groups in terms of these measures.

Signal Detection Analysis for the Positive Word-Category

The analysis used the positive targets for the hit rates and the positive unrelated intrusions for the false alarm rate. Table 3.8 (below) shows that the confabulating group had a lower d' value compared with the non-confabulating group and healthy controls, confirmed by an ANOVA that showed that the d prime scores across the three groups were significantly different: F (2, 36) = 32.75, p<.001. However there were no significant differences between the groups on B_D" estimates: F (2, 36) = 0.67, p=.52.

Table 3.8 Signal detection Analysis: Measures of Memory Strength (d') and response bias (B_D") comparing positive targets with positive unrelated intrusions between the three participant groups.

Signal Detection Analysis – Positive Hit Rate Compared with Positive Intrusions.	Signal Detection (Memory Strength)	Beta (Decision Bias)
	d'	B_D"
Confabulating Group	.62	.32
Non-confabulating Group	1.49	.52
Healthy Controls	2.46	.53

A post hoc Tukey test showed that the confabulating group had a significantly lower memory strength compared with the non-confabulating group (mean difference = 0.87, p<.01) and healthy controls (mean difference = 1.84, p<.001). In addition, memory strength in the non-confabulating group was significantly lower compared with that of healthy controls (mean difference = .97, p<.001).

Signal Detection Analysis for the Negative and Neutral Word-Categories

Signal detection analyses were also carried out for the negative and neutral word categories. The findings showed that the three groups were not significantly different in terms of d prime or response bias for both of these word categories (see Table 3.9).

Table 3.9 Signal detection Analysis: Measures of Memory Strength (d') and response bias (B_D") comparing targets with unrelated intrusions for the negative and neutral word-categories.

Signal Detection Analysis	Negative Word-Category		Neutral Word-Category	
	d'	B_D"	d'	B_D"
Confabulating Group	1.39	0.82	0.85	0.61
Non-confabulating Group	1.45	0.54	1.00	0.34
Healthy Controls	2.28	0.54	2.17	0.57

Summary of Signal Detection Results

The findings from the positive category indicated that although the three groups differed in memory strength, they used the same response criterion. The confabulating group had a significantly lower memory strength compared with the non-confabulating group and healthy controls. Furthermore, these results were not found in the negative and neutral word-categories. This suggested that confabulating patients tendency to falsely recognise more positive unrelated intrusions may be because their memory strength for positive material is significantly weaker compared with that of non-confabulating amnesia patients and healthy controls.

3.4. Discussion

Previous experimental studies have consistently examined the emotional bias in confabulation using a rating system where naive judges were asked to rate the emotional valence of the patients' confabulations (Fotopoulou et al., 2008a; Bajo et al., 2010). The present research aimed to examine the content of confabulation using the semantic-associates procedure that is recognised for its robustness in inducing false memories. The present study is the first to examine whether there are emotional biases in the content of confabulation using an affective semantic-associates procedure.

To summarize, the findings from this study suggested the following:

1) Confabulating patients correctly recalled and recognised a lower proportion of target words compared with non-confabulating patients and healthy controls.

2) Both confabulating and non-confabulating patients showed reduced false recall and false recognition to critical distracters compared with healthy controls.

3) Confabulating patients showed a positive emotional bias and falsely recognized a higher proportion of positive unrelated intrusions compared with the non-confabulating patients and healthy controls.

4) Confabulating patients falsely recognized a higher proportion of positive unrelated intrusions compared with the negative and neutral intrusions.

Schacter and colleagues (1996) used the semantic-associates procedure and found that non-confabulating amnesia patients showed reduced correct recognition of target words compared with healthy controls. This finding was interpreted in the light of poor explicit memory in amnesia. Schacter and colleagues argued that degraded explicit representation cause difficulties in remembering previously presented information. In the present study, findings showed that the confabulating patients recalled and recognised a lower proportion of target words compared with non-confabulating patients. This finding indicates that the confabulating amnesia patients' explicit memory may be more impaired compared with non-confabulating patients. This finding is consistent with the neuropsychological results, which showed that confabulating patients were more impaired in some memory tests compared with non-confabulating patients.

Furthermore, both confabulating and non-confabulating patients in the present study falsely recalled and falsely recognised a lower proportion of critical distracters compared with healthy controls. The present findings also showed that the two amnesia groups did not differ significantly in terms of the proportion of critical distracters produced. These findings are consistent with the results from Ciaramelli and colleagues (2006) work, who found that the reduced false recognition of critical distracters in confabulating patients may be due to an amnesia deficit rather than as a consequence of the impaired mechanisms specific to the confabulatory syndrome.

Schacter and colleagues (1996) argued that amnesia patients' tendency to show reduced false recall and false recognition of critical distracters may be due to a deficit in understanding the gist of the studied list. However, Koutstaal and colleagues (1999, p.336) suggested that, in response to studying a list of semantically related items, elaborative processes may “generate” or automatically activate critical distracters during encoding and/ or retrieval. Consequently, healthy participants falsely recall or recognise the critical distracter due to source confusions in terms of whether the word was previously studied or spontaneously generated. Amnesia patients show reduced false recognition of critical distracters because they are unable to generate these items. In relation to the present findings, it is currently unclear whether amnesia patients’ reduced false recall and false recognition of critical distracters is due to degraded gist memory or to a failure to generate the word during encoding and/ or retrieval.

The present study also showed that confabulating patients falsely recognised a high proportion of positive intrusions compared with non-confabulating patients and healthy controls. This finding supports Fotopoulou and colleagues (2008b) in the notion that there is a positive emotional bias in confabulation. However Fotopoulou and colleagues reported that amnesia patients’ tendency to produce pleasant confabulations is specific to self-referent information. Confabulating patients presented with a prose recall task distorted previously studied negative self-referent prose to be more positive and self-enhancing. This bias was not observed when these patients recalled non-referent prose. In the present study, the confabulating patients showed a positive emotional bias in response to studying lists of word associates from three different categories (positive, negative and neutral) that are not obviously self-referent. This suggested that the tendency to produce positive false memories may not be self-serving but represents a bias in general emotional processing.

The present research also showed that the positive bias in confabulating patients was observed in false recognition but not in false recall. The recall test examined the proportion of correctly recalled words and the spontaneous production of non-presented words (critical distracters and unrelated intrusions). In contrast, the recognition test presented participants with a display booklet containing words, which they were asked to identify, as previously presented. Therefore the recognition test examined the provoked production of non-presented words as participants were presented with the critical distracters and unrelated intrusions and to identify whether they were previously studied.

One possible explanation for why the positive bias was not observed in false recall is that the delay between the study phase and recognition test was longer for recognition than recall memory testing. Confabulating patients may have recognised a significantly high proportion of positive intrusions as a consequence of weaker memory. An inspection of figure 3.1 and figure 3.2 indicated that there is a similar pattern of results between the recall and recognition tests. Confabulating patients in both of these tests produced more positive unrelated intrusions compared with the non-confabulating patients and healthy controls. However, the proportion of positive intrusions falsely recalled in the confabulating group may have not approached statistical significance because the recall test was administered immediately after the study phase, whereas the recognition test was at a delay of approximately 15 minutes. This explanation is supported by findings from the signal detection analysis showing that confabulating patients have significantly lower memory strength in the false recognition of positive unrelated intrusions compared with non-confabulating amnesia patients and healthy controls. These findings suggested that the tendency to falsely recognise more positive intrusions may be due to weaker memory for positive information. However it is also possible that weaker memory may be due to a positive emotional bias in the content of confabulation.

In conclusion, only the findings from false recognition provide evidence for the positive emotional bias in the content of confabulation. Based on the findings from the signal detection analysis, the positive bias was only observed in false recognition because the delayed recognition test may have weakened memory in the confabulating group. Therefore the semantic-associates procedure is a weak model of confabulation. The findings from the semantic-associates procedure can only have strong implications for confabulation if the positive bias is found in both false recall and false recognition. Future studies would need to match the delay between the recall and recognition tests in order to examine the positive bias. Delaying the recall test may enhance the false recall of positive intrusions in confabulating patients. This would provide evidence of the positive bias in spontaneous confabulations.

In the present study, there were no differences between confabulating and non-confabulating patients in terms of false recall and false recognition of critical distracters. This suggested that the significantly reduced false recall and false recognition of critical distracters may be a consequence of impaired processes in amnesia. Schacter and colleagues (1998) argued that degraded gist representations in amnesia impair the ability to form a link between the studied lists and reduces the susceptibility to critical distracters. However the findings from this study do not indicate whether reduced false recall and false recognition is due to poor gist memory. As a result, the study described in the next chapter was used to address this using a facial expressions semantic-associates procedure.

Chapter 4

Study 2: The Facial Expressions Semantic-Associates Procedure

4.1. Introduction

This chapter concerns application of a pictorial semantic-associates technique to confabulating amnesia patients. Before introducing this aspect, the chapter reviews the existing theoretical work concerning the pictorial semantic-associates procedure in non-confabulating amnesia patients.

The robustness of the semantic-associates procedure has contributed to an increase in false memory research. Schacter and colleagues (1996) argued that false recognition in the semantic-associates procedure may be determined by gist memory. They explained that healthy participants are more likely to falsely remember a critical distracter because it relates to the overall gist of the previously studied list. In contrast, non-confabulating amnesia patients find it difficult to form a link between the studied words and are unable to identify the theme in the list. As a result, critical distracters evoke a stronger sense of familiarity in healthy controls than in non-confabulating amnesia patients.

In a series of controlled experiments, Schacter and colleagues (1997) constructed a pictorial semantic-associates procedure to examine false recognition in healthy participants. The procedure consisted of line drawings that were related to non-presented critical distracters. Some of the drawings were used from Roediger and McDermott's (1995) word lists and were converted into pictures. Schacter and colleagues found that the proportion of critical distracters falsely recognised in response to the pictorial procedure was significantly lower than the proportion of critical distracters produced in response to the standard procedure using written words (Schacter and Norman, 1997; Schacter and Israel, 1997). This finding led them to suggest that both gist memory and having limited access to item-specific information may determine false recognition. Schacter and colleagues argued that the pictorial semantic-associates procedure reduces the rate of false recognition because the studied pictorial items comprise distinctive perceptual representations. This increases access to item-specific information and helps in the discrimination of studied items from non-studied intrusions.

Subsequently, Koutstaal and colleagues (2001) argued that non-confabulating amnesia patients' reduced false recognition of critical distracters is subject to an alternative explanation. They referred to Johnson and colleagues' (1993) explanation of false memories in healthy participants. Johnson and colleagues argued that false memories are a consequence of confusing the source or origin of the information. Healthy participants have a difficulty in distinguishing whether the critical distracter was an actual word from the studied list or a word that was unconsciously generated in response to the studied list. Critical distracters are produced because of source confusion and are mistaken for previously studied words.

Koutstaal and colleagues (2001) applied this theory to non-confabulating patients. They postulated that as amnesia patients generally remember fewer items, they are less likely to confuse the source of the critical distracters. Koutstaal and colleagues examined this hypothesis using a semantic-associates procedure that used novel objects as stimuli. Each object was constructed from a semantically related non-presented item known as the prototype, which was later presented as a critical distracter in the recognition test. The procedure was used to reduce any source confusion. As the prototype was never seen or previously presented, participants were unlikely to produce the critical distracter spontaneously while studying the list of words. Koutstaal and colleagues argued that if non-confabulating patients' tendency to show reduced false recognition was due to a source memory deficit then these patients would show increased false recognition when presented with pictorial critical distracters. However, the results showed reduced false recognition in non-confabulating amnesia patients and supported the notion of degraded gist memory.

Schacter and colleagues (1999) developed another pictorial semantic-associates task to examine whether semantic and conceptual gist representations play a role in false recognition. They hypothesised that false recognition of critical distracters in this study would be due to perceptual and conceptual gist memory processing rather than source confusions. Non-confabulating amnesia patients were presented with pictures of common items in each category that were constructed from category-related distracters. Results showed that non-confabulating patients falsely recognised a significantly lower proportion of category-related distracters compared with healthy controls. These findings led Schacter and colleagues to conclude that gist memory is the main determinant of false recognition in the semantic-associates procedure. Non-confabulating patients show reduced false recognition due to degraded gist representations that reduce the ability to form a link between the studied lists.

In conclusion, previous studies using the pictorial semantic-associates procedure supported the notion of gist memory impairment in non-confabulating amnesia patients (Koutstaal et al., 2001; Schacter et al., 2002). However this procedure has not been previously implemented in confabulating amnesia patients. Evidence of gist memory impairment in confabulating patients would provide a new insight into the mechanisms impaired in confabulation.

Melo and colleagues (1999) argued that semantic processes modulated by the lateral temporal neocorex underlie gist memory. Subsequently, Verfaellie and Schacter (2005) argued that the brain regions related to memory such as the medial temporal lobes and diencephalon structures play a major role in the encoding of semantically-related information. Evidence of impaired gist memory in confabulating patients would suggest that the semantic processes needed to encode the relationship between items may be impaired in confabulation. On this basis, the present study is the first to examine gist memory in confabulating patients using a pictorial semantic-associates procedure.

This study also aimed to examine the emotional biases in the content of confabulation. This approach may help to address whether confabulating patients also show positive biases in response to encoding pictorial information. In this context, using facial material is appropriate because it provides the opportunity to present emotionally related items to study biases in recognition memory. The present research used emotional facial expressions to construct a pictorial semantic-associates procedure in order to address the following aims:

- To investigate whether confabulating and non-confabulating patients correctly recognise a lower proportion of pictorial target items compared with healthy controls.

- To investigate whether confabulating and non-confabulating patients falsely recognise a lower proportion of pictorial critical distracters compared with healthy controls.

- To investigate whether confabulating patients falsely recognise more non-studied intrusions from the happy emotional category compared with other categories (anger, disgust, fear, sad and neutral).

- To investigate whether confabulating patients show a positive bias to falsely recognise more happy non-studied intrusions compared with non-confabulating patients and healthy controls.

- To investigate whether the overall rate of false recognition in all three groups is reduced in this study compared with study 1.

4.2. Method

This section describes the recruitment of participants for this study and the experimental procedure.

4.2.1. Participants

This study comprised the same three groups of participants who took part in study 1: 13 confabulating amnesia patients, 13 non-confabulating amnesia patients and 13 healthy controls. Participants' demographic and diagnostic characteristics are not presented in this section as they have already been described in the previous chapter.

4.2.2. Neuropsychological Measures

The three groups of participants completed neuropsychological tests before they were administered the experimental procedures. The neuropsychological results have been presented in the previous chapter.

4.2.3. The Facial Expressions Semantic-Associates Procedure

A facial expressions semantic-associates procedure was constructed for the present study using the photographs from Kohler (2003). The materials used to create this procedure were described in the method chapter. The facial expressions semantic-associates procedure was administered in the following manner:

1. <u>Study Phase</u> - Participants were presented with photographs from six emotional categories: anger, disgust, fear, sad, neutral and happy (see Appendix 2.5). Each category contained 10 photographs that were

associates to one non-presented critical distracter. Each photograph was printed on a single page inside an A5 display booklet. The participants were asked to study each photograph for three seconds while the researcher turned the page to display the next item. All the photographs were displayed inside a single display booklet.

2. Recognition Test - Participants were presented with a single display booklet containing 36 previously studied photographs. Six of the photographs were from each emotional category. This booklet also contained 36 new non-presented intrusions and six critical distracters that had not been previously studied but were related to each emotional category (see Appendix 2.5). Participants were asked whether they had been previously presented with each photograph in the study phase of the experiment and to respond with either ‘yes’ or ‘no’.

4.3. Results

This section presents the analysis of results and the findings obtained from the present study.

4.3.1. Analysis of Results

A repeated measures ANOVA was used to analyse participants’ performance on the facial expressions semantic-associates procedure. The experimental results are presented below.

4.3.2. Experimental Results

Recognition results obtained from the affective semantic-associates procedure were analysed for all three groups. Table 4.1 (below) shows mean and standard deviations for the proportion of target items, critical distracters and non-studied intrusions produced in the recognition test between the three groups of participants.

Three separate repeated measures ANOVAs were conducted to analyse the three dependent variables: previously studied (target) items, category-related (critical) distracters and non-studied intrusions.

Table 4.1: Recognition Results: Mean scores (standard deviations) for the proportion of target items, critical distracters and non-studied intrusions produced in the recognition test between the three participant groups.

Facial Expression Semantic-Associates Procedure	Confabulating Group	Non-confabulating Group	Healthy Controls
	Mean (SD)	Mean (SD)	Mean (SD)
Proportion of Target items:			
Anger Target	.44 (.31)	.51 (.29)	.79 (.24)
Disgust Target	.46 (.29)	.44 (.20)	.73 (.22)
Fear Target	.39 (.20)	.46 (.23)	.52 (.30)
Sad Target	.47 (.27)	.55 (.29)	.68 (.21)
Neutral Target	.56 (.19)	.51 (.31)	.65 (.24)
Happy Target	.48 (.24)	.36 (.32)	.68 (.24)
Proportion of Critical Distracters:			
Anger Critical Distracters	.15 (.38)	.23 (.44)	.46 (.52)
Disgust Critical Distracters	.08 (.28)	.15 (.38)	.69 (.48)
Fear Critical Distracters	.23 (.44)	.23 (.44)	.69 (.48)
Sad Critical Distracters	.00 (.00)	.08 (.28)	.38 (.51)
Neutral Critical Distracters	.08 (.28)	.08 (.28)	.69 (.48)
Happy Critical Distracters	.15 (38)	.15 (.38)	.54 (52)
Proportion of Non-studied Intrusions:			
Anger Non-studied Intrusions	.10 (.11)	.13 (.14)	.08(.09)
Disgust Non-studied Intrusions	.12 (.12)	.08 (.11)	.01 (.05)
Fear Non-studied Intrusions	.05 (.08)	.13 (.15)	.03 (.06)
Sad Non-studied Intrusions	.12 (.14)	.09 (.11)	.08 (.13)
Neutral Non-studied Intrusions	.10 (.13)	.12 (.14)	.04 (.07)
Happy Non-studied Intrusions	.17 (.13)	.13 (.17)	.09 (.11)

Results for Target Items

A repeated measures ANOVA was used to examine the proportion of target items recognised from the six emotional categories (anger, disgust, fear, sad, neutral and happy) between the three groups (confabulating group, non-confabulating group and healthy controls). There was a significant main effect of Group: F (2, 36) = 5.87, p<.01 and a main effect of Emotional category: F (5, 180) = 2.40, p<.05. However, there was no significant interaction between Group and Emotional category: F (10, 180) = 1.53, p = .13. These findings suggested that the groups differed in terms of the proportion of targets recognised, but not across the emotional categories.

Tukey post-hoc analyses were also carried out to explore the significant main effect of Group from a one-way ANOVA. Findings showed that the two amnesia groups recognised a significantly lower proportion of target items compared with healthy controls: confabulating group (mean difference = .21, p<.05) and non-confabulating group (mean difference= .20, p<.05). However, there were no significant differences in the proportion of target items recognised between the confabulating and non-confabulating groups (mean difference = .01, p=1.00).

Paired-sample t-tests were carried out to explore the significant main effect of Emotional category. Findings showed that overall participants recognised a significantly lower proportion of targets from the fear category compared with targets from the anger category (t (38) = 3.04, p<.01), the sad category (t (38) = 2.67, p<.05) and the neutral category (t (38) = 2.87, p<.01).

Results for Critical Distracters

Repeated measures ANOVA was used to examine the proportion of critical distracters recognised from the six emotional categories (anger, disgust, fear, sad, neutral and happy) between the three groups (confabulating group, non-confabulating group and healthy controls). There was a significant main effect of Group: F (2, 36) = 20.12, p<.001. However, there was no significant main effect of Emotional category: F (5, 180) = 1.49, p=.20. There was also no significant interaction between Group and Emotional category: F (10, 180) = .58, p=.83. These findings indicated that there were significant differences between the groups in terms of the proportion of critical distracters recognised, but not across the emotional categories.

Post-hoc analyses were also carried out to explore the significant main effect of Group from a one-way ANOVA. Findings showed that the two patient groups recognised a significantly lower proportion of critical distracters compared with healthy controls: confabulating group (mean difference = .46, p<.001) and non-confabulating group (mean difference= .42, p<.001). However, there were no significant differences in terms of the proportion of critical distracters falsely recognised between the confabulating and non-confabulating amnesia groups (mean difference = .04, p=.88). These findings indicated that both the confabulating and non-confabulating patients showed reduced false recognition of critical distracters compared with healthy controls.

Signal Detection Analysis for the Critical Distracters

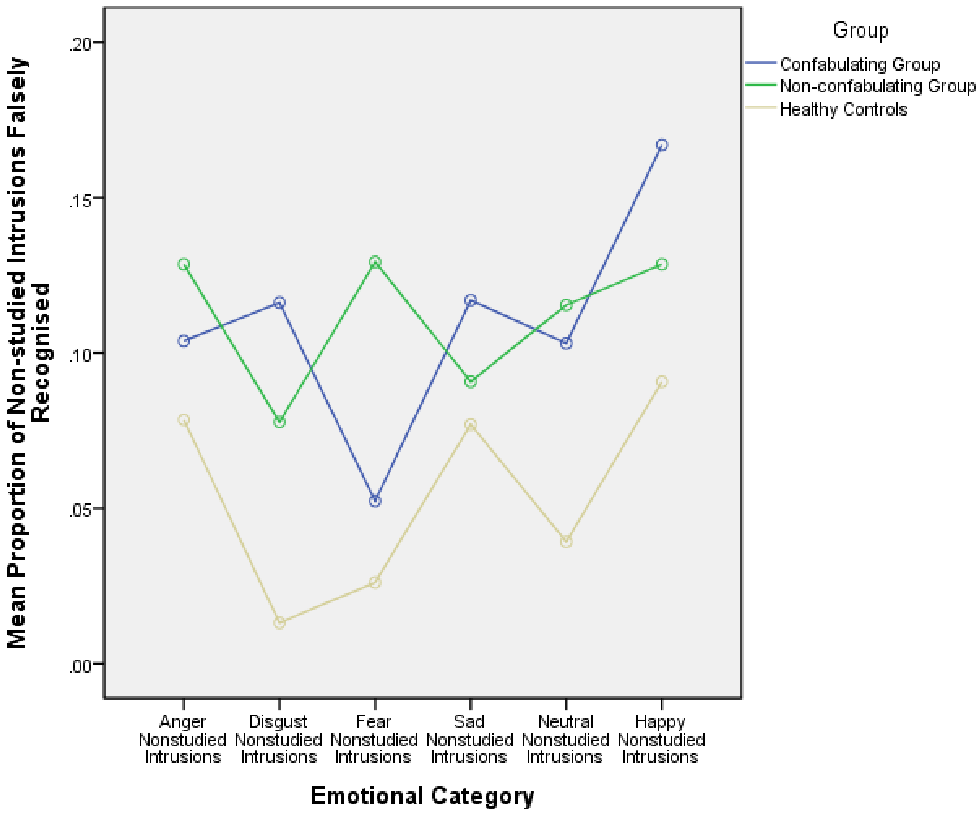
A signal detection analysis was carried out using rates of endorsement of target words (hit rate) with rates of selection of critical distracters (false alarms). This analysis was carried out to examine differences in memory strength (d prime) and response bias (B_D") between the three groups on this test. Findings showed that there were no significant differences between the three groups in terms of memory strength: F (2, 36) = 2.52, p=.09. However there were significant differences between the groups on B_D" estimates: F (2, 36) = 3.20, p=.05.

A post hoc Tukey test showed that the confabulating group had a significantly higher B_D" estimate compared with healthy controls (mean difference = 0.48, p=.04). However, there were no significant differences found between the confabulating and non-confabulating amnesia groups (mean difference = .17, p=.65). These findings indicated that the confabulating group used a more conservative response criterion compared with healthy controls. No significant differences were found between the non-confabulating group and healthy controls on B_D" estimate.

Results for Non-studied Intrusions

Figure 4.1 illustrates that both the confabulating and non-confabulating groups falsely recognised more non-studied intrusions across all the emotional categories compared with healthy controls.

Figure 4.1: False Recognition of non-studied Intrusions: Mean proportion of non-studied intrusions from the positive, negative and neutral categories falsely recognised by the three groups of participants: 13 confabulating amnesia patients, 13 non-confabulating amnesia patients and 13 healthy controls.



A repeated measures ANOVA was used to examine the proportion of non-studied intrusions recognised from the six emotional categories (anger, disgust, fear, sad, neutral and happy) between the three groups (confabulating group, non-confabulating group and healthy controls). There was a significant main effect of Group: F (2, 36) = 5.48, p<.01. However, there was no significant main effect of Emotional category: F (5, 180) = 1.46, p=.21. There was also no significant interaction between Group and Emotional category: F (10, 180) = .62, p=.79. These findings indicate group differences in terms of the proportion of non-studied intrusions falsely recognised. However, there were no significant differences in the proportion of non-studied intrusions recognised across the emotional categories.

Tukey post-hoc analyses were then carried out to explore the significant main effect of Group. Findings showed that both the confabulating and non-confabulating groups falsely recognised significantly more non-studied intrusions compared with healthy controls: confabulating group (mean difference = .05, $p<.05$) and non-confabulating group (mean difference= .06, $p<.05$). However, there were no significant differences in terms of the proportion of non-studied intrusions falsely recognised between the confabulating and non-confabulating groups (mean difference = .00, $p=.99$). These findings indicated that confabulating and non-confabulating patients show increased false recognition of non-studied intrusions compared with healthy controls.

<u>Results comparing false recognition between studies 1 and 2</u>

Table 4.2 (below) shows mean proportion of critical distracters and non-studied intrusions falsely recognised across the three groups of participants in studies 1 and 2. This shows that the confabulating and non-confabulating groups falsely recognised a lower proportion of critical distracters and non-studied intrusions in the present study compared with study 1. Findings for the proportion of critical distracters across the two studies are further described below. This is followed by a description of the findings comparing the proportion of non-studied intrusions across studies 1 and 2.

Table 4.2: Comparing False Recognition between Studies 1 and 2: Mean proportion of critical distracters and non-studied intrusions produced in the recognition test between the three participant groups in studies 1 and 2.

Recognition Test	Confabulating Group		Non-confabulating Group		Healthy Controls	
	Study 1	Study 2	Study 1	Study 2	Study 1	Study 2
Proportion of Critical Distracters	.31	.11	.32	.15	.56	.58
Proportion of Non-studied Intrusions	.22	.11	.18	.11	.08	.05

Results for critical distracters between studies 1 and 2

A repeated measures ANOVA was used to examine the proportion of critical distracters falsely recognised from two study-types (study 1 and study 2) between the three groups of participants. There was a significant main effect of Group: F (2, 36) = 22.18, p<.001. There was also a significant main effect of Study-Type: F (1, 36) = 4.97, p<.05. However, there was no significant interaction between Group and Study-Type: F (2, 36) = 1.78, p =.18. These findings suggest that the groups differed in terms of the proportion of critical distracters falsely recognised. The findings also indicated that there were significant differences in the proportion of critical distracters recognised between the two studies, but not in relation to group differences.

Paired-sample t-tests were carried out for each group to compare the proportion of critical distracters between studies 1 and 2. The two amnesia groups falsely recognised a significantly lower proportion of critical distracters in study 2 compared with study 1: confabulating group (t (12) = 2.29, p<.05) and non-confabulating group (t (12) = 2.36, p<.05). In contrast, healthy controls showed no significant difference in terms of the proportion of critical distracters produced between studies 1 and 2: (t (12) = .20, p=.85). These findings indicated that pictorial material reduced false recognition of critical distracters in amnesia patients.

Results for non-studied intrusions between studies 1 and 2

A repeated measures ANOVA was used to examine the proportion of non-studied intrusions from two study-types (study 1 and study 2) between the three groups of participants. There was a main effect of Group: F (2, 36) = 16.21, p<.001. There was also a significant main effect of Study-Type: F (1, 36) = 21.30, p<.001. However, there was a near-significant interaction between Group and Study-Type: F (2, 36) = 2.86, p =.07. These findings suggested that there were significant differences in the proportion of non-studied intrusions falsely recognised between the two studies.

Paired-sample t-tests were also carried out for each group to compare the proportion of non-studied intrusions between studies 1 and 2. This analysis showed that the two amnesia groups produced significantly more non-studied intrusions in study 1 compared with study 2: confabulating group (t (12) = 4.18, p<.01) and non-confabulating group (t (12) = 2.25, p<.05). Healthy controls showed no significant difference in terms of the proportion of non-studied intrusions falsely recognised between studies 1 and 2: (t (12) = 1.34, p=.21). These findings indicated that the encoding of pictorial items also significantly reduced the rate of false recognition in both confabulating and non-confabulating amnesia patients.

Summary of Results

Findings from this study replicated the results from study 1 and showed that both confabulating and non-confabulating patients recognised a significantly lower proportion of target words and non-presented critical distracters compared with healthy controls. However, in contrast to the results from study 1, findings from the present study showed no evidence of the positive emotional bias in confabulation. No significant differences were found between the three groups in terms of the proportion of non-studied intrusions falsely recognised across all the emotional categories. Findings also showed that both confabulating and non-confabulating patients falsely recognised a lower proportion of critical distracters and non-studied intrusions in this study compared with study 1. This indicated that pictorial stimuli in the semantic-associates procedure reduced false recognition in amnesia patients.

4.4. Discussion

Previous studies examined gist memory in non-confabulating amnesia patients and healthy controls using the pictorial semantic-associates procedure (Koutstaal et al., 1999; Schacter et al., 1997; Schacter et al., 2002). Koutstaal and colleagues (1999) found that non-confabulating patients showed reduced false recognition of pictorial critical distracters compared with healthy controls. They suggested that healthy participants falsely recognised a critical distracter based on its conceptual and perceptual similarity to the previously studied items. Koutstaal and colleagues concluded that non-confabulating patients' tendency to falsely recognise a lower proportion of critical distracters might be due to degraded gist memory in amnesia (Koutstaal et al., 2001; Schacter et al., 2002).

However, the pictorial semantic-associates procedure had not been used in confabulating amnesia patients. Therefore, the present research used this procedure by incorporating faces with different emotions to examine the positive emotional bias that has been associated with confabulation. The second aim of this study relates to the findings from study 1 presented in the previous chapter. The results from the previous chapter showed that confabulating patients falsely recognised a lower proportion of critical distracters compared with healthy controls. However, study 1 did not explain why confabulating and non-confabulating amnesia patients were less susceptible to critical distracters compared with healthy controls. Therefore, the present study also aimed to address whether confabulating patients' tendency to show reduced false recognition to critical distracters is due to gist memory impairment.

To summarise, the findings from this study suggested the following:

1) Both confabulating and non-confabulating amnesia patients correctly recognised a lower proportion of target items compared with healthy controls.

2) Both confabulating and non-confabulating patients showed reduced false recognition of critical distracters compared with healthy controls.

3) Confabulating patients did not show a positive bias in the false recognition of non-studied intrusions.

4) Relative to healthy controls, both confabulating and non-confabulating patients showed reduced false recognition of critical distracters and non-studied intrusions in the present study compared with study 1.

Previous research using the semantic-associates procedure showed that non-confabulating patients correctly recognised a lower proportion of target items compared with healthy controls (Schacter et al., 1996; Koutstaal et al., 2001). It was argued that amnesia patients had poor explicit representations, which affected their ability to remember previously presented information. In the present study, both confabulating and non-confabulating patients showed significantly reduced correct recognition compared with healthy controls. Moreover, there were no differences between the two amnesia groups in terms of the proportion of correctly recognised targets. This finding supported previous theories in the notion of impaired explicit memory in amnesia patients.

In the study described in the previous chapter, a positive emotional bias was found in the confabulating group. These patients falsely recognised more emotionally positive non-studied intrusions, compared with non-confabulating patients and healthy controls. This positive bias was not found in the present study using the pictorial semantic-associates procedure. In the confabulating group, no differences were found in the proportion of non-studied intrusions falsely recognised across all the emotional categories. These findings suggested that confabulating patients may have had less difficulty processing pictorial stimuli.

Schacter and colleagues (1997) argued that pictorial items form unique conceptual and perceptual representations. Encoding of pictorial items helps in the discrimination of studied items from non-studied intrusions. In relation to the current findings, this suggested that when patients with impaired memory and executive processes are unable to discriminate between true memories and imagined constructs, emotional processing biases give rise to confabulations.

The present study is the first to use a pictorial semantic-associates procedure to examine false recognition in confabulating amnesia patients. This has provided a novel finding showing that both confabulating and non-confabulating patients falsely recognised a lower proportion of pictorial critical distracters compared with healthy controls. This suggested that the semantic processing mechanisms needed to encode the relationship between items may be impaired in these patients. However, both confabulating and non-confabulating patients did not differ in terms of the proportion of critical distracters falsely recognised. This indicated that there were no differences between the two groups in the severity of their gist memory deficit. This implies that confabulating patients’ reduced false recognition results from their amnesia deficit rather than the impaired mechanisms specific to confabulation. The finding of reduced false recognition in this study is a marker of poor gist memory in amnesia with or in the absence of confabulation.

However, findings from a series of studies led Mayes and colleagues (1980) to conclude that amnesia patients’ show a normal pattern of performance in processing semantic information. These findings contradicted the notion that there is degraded gist memory in amnesia. Amnesia patients’ and healthy controls were presented with lists of shapes to study. Amnesia patients were administered a recognition test immediately after the presentation of each list, while healthy controls were tested after a longer retention interval. Mayes and colleagues delayed the recognition test in controls in order to equate memory performance of amnesic patients and controls. They argued that delaying the memory tests prevents interaction effects which can arise as a result of having different memory strengths. The findings showed that amnesia patients’ performance was similar to healthy controls. Both amnesia patients and healthy controls’ recognition memory performance improved in a high level task where they were asked to produce a label (i.e. meaningful interpretation) for each item during learning. In addition, the two groups did worse on a low level task where they were asked to count the number of sides of each presented shape during learning. The finding that the two groups performed better in the high level task indicated that they attached strongly meaningful labels to the shapes during learning and retrieval. Mayes and colleagues argued that as the high level task had a similar effect on recognition in the two groups; it was possible that the amnesia patients used semantic processes during learning similar to controls.

Mayes and colleagues (1981) also showed that delayed memory in healthy controls was similar to amnesic immediate memory. In relation to the semantic-associates procedure, the finding of reduced false recognition of critical distracters in amnesia may not be due to gist memory impairment, but rather a significantly weaker memory in amnesia patients compared with healthy controls. However, using a signal detection analysis, findings in the present study showed that there were no significant differences between the three groups on memory strength. This indicated that the significantly reduced false recognition of critical distracters in the confabulating and non-confabulating groups may not be due to weaker memory. However, the confabulating group used a more conservative response criterion during the recognition of critical distracters compared with healthy controls, but not when compared with the non-confabulating group. It can be argued that conservative responding in the confabulating group may be a consequence of degraded gist memory which makes it more difficult to form a link between the studied lists.

Schacter and colleagues (1997) found that the use of pictures in the semantic-associates procedure 'suppressed' overall false recognition in healthy controls. They suggested that pictures are easier to retrieve than words because they comprise detailed item-specific information that enhances encoding mechanisms and helps to reject non-presented items. The findings from the present study were compared with those in study 1 in terms of the proportion of critical distracters across the three groups. Relative to healthy controls, the findings showed that the confabulating and non-confabulating patients falsely recognised a significantly lower proportion of critical distracters and non-studied intrusions using pictorial stimuli compared with written stimuli. This indicated that the pictorial stimuli reduced false recognition of non-presented items in amnesia patients.

A possible explanation for these findings is proposed in relation to Schacter's theory of degraded gist memory in amnesia. Healthy participants in the present study may have falsely recognised pictorial critical distracters because these items evoke emotional facial expressions that were perceptually and conceptually similar to the studied items. In contrast, amnesia patients' degraded gist memory may have reduced their ability to form a link between the facial expressions in each category. Consequently, these patients may have relied on the features in the photographs (such as the face, eyes, hair) rather than the emotion being expressed. As a result, amnesia patients may have rejected more pictorial distracters because these items did not have the item-specific details associated with the studied items.

However, one limitation is that the recognition test in this study was administered immediately after the study phase, whereas the recognition test in study 1 was administered at a delayed retention interval. Therefore, it is possible that false recognition was significantly higher in study 1 because the delayed recognition test may have weakened memory.

In conclusion, confabulating and non-confabulating patients' tendency to show reduced false recognition of critical distracters indicated degraded gist memory in amnesia. Confabulating patients did not show a greater false recognition rate than non-confabulating patients. This suggested that degraded gist memory is due to an amnesic deficit and is not specific to confabulation.

In comparison to healthy controls, the confabulating and non-confabulating amnesia patients also showed reduced false recognition of critical distracters and non-studied intrusions in the present study compared with study 1. This suggested that both confabulating and non-confabulating patients may have relied on item-specific knowledge about the studied items (i.e. facial features) in rejecting critical distracters and non-studied intrusions. However, the reduced false recognition rate found in this study might have also been due to the administration of the recognition test immediately after the study phase.

Chapter 5

Study 3: Mood Induction and the Affective Semantic-Associates Procedure

5.1. Introduction

Fotopoulou and colleagues (2004, 2008a) have reported that confabulating patients show a tendency to produce positive and self-enhancing false memories about themselves in contrast to non-confabulating patients and healthy controls. They have argued that the positive bias in confabulation serves to maintain well-being and self-coherence in an otherwise confusing and sometimes stressful circumstance (Fotopoulou, 2009). The present study aimed to examine whether mood influences the positive emotional bias in confabulating amnesia patients using a video mood induction procedure. In this study, confabulating amnesia patients, non-confabulating amnesia patients and healthy controls were induced to negative and positive mood states followed by an affective semantic-associates procedure.

Conway and Pleydell-Pearce (2000) argued that emotions, personal goals and the wish for self-coherence may shape the manner in which confabulations occur in the context of brain injury or disease (Conway and Pleydell-Pearce, 2000; Fotopoulou, 2008; Burgess and McNeil, 1999). According to this hypothesis, executive processes guide the reconstruction of memories in order to maintain self-coherence. When executive processes are impaired, memories are altered or confabulations are produced to support current goals (Conway and Pleydell-Pearce, 2000). This theory was subsequently used as a basis for suggesting that emotional biases in confabulation arise when personal goals are exaggerated in autobiographical memory reconstruction (Fotopoulou et al., 2007).

Fotopoulou and colleagues (2008a) obtained a “paradoxical” finding showing that the higher the confabulating patients rating on the depression scale, the greater the production of pleasant and self-enhancing confabulations. This correlation between negative mood and pleasant confabulations led to the conclusion that further research is needed to investigate whether low mood triggers confabulations (Fotopoulou et al., 2008a, pp.771).

However, Metcalf and colleagues (2010) obtained contrasting findings showing that patients who were clinically depressed often produced fewer pleasant confabulations. Bajo and colleagues (2010) obtained similar findings in a more recent study examining the affective valence of confabulation. They found a weak positive correlation between depression and unpleasant confabulations. This led to the conclusion that the effects of low mood on the content of confabulation is “subtle and not necessarily specific to confabulations” (Bajo et al., 2010, p.981).Therefore, the role of emotions on the content of confabulation is currently unclear and further research is needed to investigate this topic.

Previous studies have employed a variety of mood induction procedures to examine more generally the effects of mood on recall in healthy participants. These studies induced participants into negative and positive mood conditions prior to studying lists of words (Bower et al., 1981; Scharff et al., 2003; Storbeck and Clore, 2005; McCabe and Gotlib, 1993).

Some of the earliest studies on this topic used mood simulation techniques. For example, a well-recognised procedure known as the Velten technique involves healthy participants simulating feelings of happiness or sadness while studying a list of statements from three different categories (positive, negative and neutral) (Velten, 1968). The technique has been used to demonstrate mood congruent bias with participants recalling a higher proportion of affective information that was congruent to the simulated mood (Bower et al., 1981; Kenealy, 1997).

However, investigations of the mood congruent phenomenon were met with some inconsistencies. Some studies failed to replicate the mood congruent effect and argued that this memory bias is an unstable phenomenon (Tobias, 1992).

More recently, Ruci and colleagues (2009) examined mood congruent false memories in healthy participants. Participants were administered negative and positive mood inductions prior to studying lists of affective words from Roediger and colleagues (2001). This study used a mood simulation technique where participants were asked to simulate the emotions that were being depicted in the story entitled 'The Lottery Ticket'. They found that participants falsely recognised more critical distracters that matched the mood state induced during the time of learning the studied lists. An important issue in conducting such research is the success and validity of the mood induction technique. In this regard, mood simulation techniques successfully induced positive and negative mood states in healthy participants (Ruci et al., 2009). However, mood simulation techniques have received much criticism. Fiedler and colleagues

(2001) argued that procedures such as the Velten technique may not be inducing reliable mood states. They argued that when participants are asked to stimulate a specific mood, the outcome of the experiment becomes more obvious. Consequently, the participants may respond by acting towards how they think they should behave. Fiedler and colleagues argued that the findings of a mood congruent effect using this procedure may be the result of response bias rather than genuine mood states.

Some studies employed musical mood induction procedures as an alternative approach to the Velten technique (Gerrards-Hesse et al., 1994; Kenealy, 1997). These studies found that participants in the positive musical condition reported higher levels for happiness than participants in the sad musical condition. Martin (1990) argued that this procedure is effective in inducing negative mood states particularly depression, but less efficient in inducting elated mood compared with the Velten technique.

Video mood induction procedures have been shown to induce temporary but robust mood states (Kunzmann and Gruhn, 2005; Mograbi et al., 2012). This procedure consists of films that portray stories with pleasant or unpleasant emotional content. For example, Kunzmann and Gruhn (2005) used sad film clips to induced negative emotional reactions. Mood was measured using self-report questionnaires. Participants' heart rate and the electrical conductance of the skin were also monitored. This procedure was found to induce high levels of sadness in older adults. Subsequently, Mograbi and colleagues (2012) used film clips to induce positive, negative and neutral mood states. This procedure was found to induce reliable mood states in Alzheimer's patients and controls.

To date, previous studies have not used a mood induction procedure to examine the effects of mood on confabulation. The present study used negative mood video clips from Kunzmann and Gruhn's (2005) study (also used by Mograbi et al 2012) and a positive mood video from Mograbi and colleagues (2012) to induce mood changes. Participants completed video mood induction prior to the administration of the affective semantic-associates procedure. This study aimed to address the following:

- To investigate whether the video mood induction procedures induce all three groups of participants into positive and negative mood states.

- To investigate whether all participants recall and recognise more affective target words that are congruent to the induced mood state.

- To investigate whether confabulating patients falsely recall and falsely recognise more positive critical distracters in the negative mood condition compared with the positive mood condition.

- To investigate whether confabulating patients falsely recall and falsely recognise more positive unrelated intrusions in the negative mood condition compared with the positive mood condition.

- To investigate whether confabulating patients falsely recall and falsely recognise more positive unrelated intrusions in the positive and negative mood conditions compared with non-confabulating patients and healthy controls.

5.2. Method

The method section of chapter 5 will begin by discussing participants demographic and clinical diagnoses. This will be followed by a brief summary of the chosen background neuropsychological tests. In the later part of this section, the experimental procedure used in this study will be discussed.

5.2.1. Participants

This study comprised three new groups (confabulating; confabulating amnesic; and healthy controls) each consisting of 13 participants.

All participants were recruited based on the inclusion and exclusion criteria described in chapter 2.

Matching Variables

All three groups were matched on demographic variables. The confabulating and non-confabulating groups were also matched on the severity of amnesia based on the WMS-IV immediate subtests.

Participants Demographic Differences

Statistical differences between the three groups on gender, age and level of education were examined. Table 5.1 (below) shows the mean percentage of males and females in each of the three participant groups. The table also shows the means and standard deviations for age and level of education.

A chi-square test for independence (with Fisher's Exact Test) showed no significant gender differences between the groups: X^2 (2, n = 39) =.38, p = 1.00.

A one-way ANOVA showed no statistically significant age differences between the groups (F (2, 36) = 2.38, p = .11) and level of education (F (2, 36) = 1.58, p = .22).

Table 5.1: <u>Demographic difference:</u> The mean (SD) and significant differences on age and gender between the confabulating patients, non-confabulating patients and healthy controls.

	Confabulating Group N=13	Non-confabulating Group N=13	Healthy Controls N=13
Gender			
% Male	76.9%	69.2%	76.9%
% Female	23.1%	30.8%	23.2%
Age			
Means (SD)	56.9 (9.9)	50.9 (11.2)	48.2(10.0)
Level of Education			
Means (SD)	13.46 (1.20)	13.77 (1.30)	14.31 (1.18)

<u>Participants standard deviation differences based on the WMS-IV subtests</u>

Table 5.2 (below) shows the differences between the z scores for the WMS-IV memory tests and z scores for current (WASI) IQ. Amnesia patients were recruited based on the criterion that their memory score is less than 1.5 standard deviations below their current measured IQ.

Table 5.2: <u>Matching variables:</u> shows the Z score differences between the WMS-IV memory performance and current IQ.

WMS-IV (Subtests)	Confabulating Group		Non-confabulating Group		
	Mean Raw scores (SD)	Mean Z Score Corrected for IQ	Mean Raw Scores (SD)	Mean Z Score Corrected for IQ	t- value, df (24)
Logical Memory	11.85 (8.13)	-2.40 (.42)	15.08 (4.65)	-2.23 (.58)	-.85
Verbal Paired Associates	9.62 (6.83)	-2.26 (.33)	15.15 (9.41)	-2.09 (.57)	-.97
Visual Reproduction	18.54 (8.74)	-2.26 (.54)	24.31 (7.89)	-2.17 (.68)	-.38

Table 5.2 shows that the confabulating and non-confabulating patients', as would be expected by definition, showed overall performance on the memory/IQ subtest difference greater than 1.5 standard deviations. Furthermore, an independent-samples t-test showed that there were no significant differences between the two groups on z scores.

<u>Clinical Diagnoses in the Confabulating Group</u>

Table 5.3 (below) shows the confabulating and non-confabulating patients grouped according to their clinical diagnoses at the time of recruitment.

The majority in the confabulating group were diagnosed with Wernicke-Korsakoff Syndrome. Traumatic brain injury was the second most commonly observed pathology in the confabulating group and was often the result of vehicle accidents and falling (2/2). Cerebrovascular disease in the current sample was predominantly caused by hypertension (2/2). Encephalitis in the confabulating group was cause by an autoimmune limbic system. Epilepsy was diagnosed in one confabulating patient as a result of recurrent seizures emanating from the temporal lobe region. A confabulating patient in the current sample was diagnosed with systemic lupus erythematosus; this patient had a neuropsychiatric syndrome including headaches and degraded anterograde memory.

Clinical Diagnoses in the Non-confabulating Group

In the non-confabulating group, the majority of the patients again had Wernicke-Korsakoff syndrome. HIV and traumatic brain injury were also common in this group. HIV in one of the non-confabulating patients was found in the context of Pneumocystis Carinii Pneumonia. Encephalitis in the non-confabulating group was cause by potassium channel (VGKC) complex autoantibodies.

Clinical MRI scans were obtained for 10 confabulating patients and 7 non-confabulating patients (see appendix 3.0 for the clinical reports on patients' individual MRI scans).

Table 5.3: Clinical Diagnoses 13 confabulating amnesia patients and 13 non-confabulating amnesia patients were grouped according to their clinical diagnoses at the time of recruitment.

Pathology	Confabulating Group	Non-confabulating Group	Total
Traumatic Brain Injury	2 (15.4%)	2 (15.4%)	4 (10.3%)
Wernicke-Korsakoff Syndrome	5 (38.5%)	8 (6.15%)	13 (33.3%)
Cerebrovascular Disease	2 (15.4%)	0 (0%)	2 (5.1%)
HIV Encephalopathy	1 (7.7%)	2 (15.4%)	3 (7.7%)
Epilepsy	1 (7.7%)	0 (0%)	1 (2.6%)
Encephalitis	1 (7.7%)	1 (7.7%)	2 (5.1%)
Systemic Lupus Erythematosus	1 (7.7%)	0 (0%)	1 (2.6%)

5.2.2. Screening and Neuropsychological Measures

As described in chapter 2, all participants were administered screening and background neuropsychological tests prior to the experimental procedures.

5.2.3. Experimental Procedure

Mood induction preceded the affective semantic–associates procedure. There were two conditions, one with positive and the other with negative induction, presented on separate occasions. The order was counter-balanced with half of the participants for each order. The materials used to construct this procedure are described in more detail in chapter 2.

1. Mood Induction Procedure – In the positive mood condition, participants watched a seven minute scene from the British comedy series entitled ‘Dad’s Army’. In the negative condition, a ten minute edited scene from a film

entitled ‘One True Thing’ depicting a story about terminal cancer was used. The video clips were presented to participants using an Acer Notebook computer connected to portable Philips 2.0 watts multimedia speakers to accommodate participants with mild hearing difficulties. The Positive Affect Negative Affect Scale (PANAS) was completed immediately after the presentation of each video clip.

2. Semantic-Associates Procedure: Study Phase – This procedure involved the presentation of 6 lists of words, with each list containing 15 word associates to one non-presented critical distracter. The lists were presented in two A5 display booklets, each containing three word-lists belonging to one of the following categories, positive, negative and neutral. Each word was printed on a single page and shown for three seconds. The booklet pages were turned at a rate to determine this study time.

3. Semantic-Associates Procedure: Recall Test Phase – Free recall tests were administered immediately after the presentation of each list. Once participants completed the recall test for all 6 lists, they were then administered the recognition test.

4. Semantic-Associates Procedure: Recognition Test Phase – This test comprised a single display booklet containing 24 previously studied words, 24 new non-presented unrelated intrusions and 6 critical distracters that had not been previously studied but were related to the words presented in the study phase. Participants were asked whether they had previously been

presented with each word in the study phase of the experiment and to respond with either ‘yes’ or ‘no’.

5.3. Results

This section will be introduced by discussing the results for each neuropsychological test administered to the three groups of participants. This is followed by a discussion of the results obtained from the confabulation interview. Finally, the results obtained from the semantic- associates procedure will be discussed.

5.3.1 Neuropsychological Results

The data obtained from the neuropsychological tests were first analysed using one-way ANOVAs. In addition, the confabulating and non-confabulating amnesia groups were compared on memory and executive measures using an independent-samples t-test.

Table 5.4 (below) shows the means, standard deviations and percentile scores of the three groups on the neuropsychological tests. This is followed by a description of the findings on participants’ performance on each neuropsychological measure.

Table 5.4: Neuropsychological Results: Mean raw scores, standard deviations and percentile scores on neuropsychological tests between the three groups.

Neuropsychological Tests	Confabulating Group N=13		Non-confabulating Group N=13		Healthy Controls N=13	
	Mean (SD)	%ile	Mean (SD)	%ile	Mean (SD)	%ile
NART Full Scale IQ	106.9 (11.2)	66th	107.8 (9.3)	68th	108.4 (8.9)	70th
WASI (2-subtests)						
Vocabulary	54.5 (9.2)	37th	58.3 (8.8)	50th	57.9 (8.8)	50th
Matrix Reasoning	21.0 (5.1)	63rd	24.1 (4.3)	75th	27.9 (3.3)	84th
WASI Full Scale IQ	103.6 (15.0)	61st	109.0 (10.0)	73rd	109.5 (9.8)	73rd
WMS IV (immediate subtests)						
Logical Memory	11.9 (8.1)	2nd	15.1 (4.6)	5th	33.8 (3.4)	84th
Verbal Paired Associates	9.6 (6.8)	2nd	15.2 (9.4)	9th	36.4 (9.5)	75th
Visual Reproduction	18.5 (8.7)	2nd	24.3 (7.9)	5th	41.2 (2.1)	91st
RMT						
Word Recognition	31.8 (7.8)	1st	36.9 (8.2)	5th	46.2 (2.7)	75th
Face Recognition	30.2 (6.8)	1st	33.3 (6.8)	5th	42.8 (3.4)	25th
Hayling Test						
Sentence Completion (Time)	23.2 (14.0)	5th	20.0 (17.6)	10th	12.2 (7.9)	25th
Unconnected Completion (Time)	70.6 (31.7)	10th	51.9 (31.1)	25th	39.8 (21.9)	50th
Unconnected Completion (Error)	19.0 (10.3)	1st	13.1 (14.9)	10th	1.40 (2.0)	75th
Brixton Test						
Error Score	23.9 (6.2)	10th	21.4 (6.9)	10th	11.5 (3.0)	75th

Premorbid and Current Intellectual Ability

An inspection of the means on the NART-R and WASI tests on Table 5.4 indicated that the confabulating patients' current intellectual ability mildly deteriorated from their level of premorbid cognitive functioning. An ANOVA analysis of these results revealed no significant difference between the three groups on the NART-R (F (2, 36) = .07, p = .93) and WASI Full-Scale IQ (F (2, 36) = .98, p = .39).

Anterograde Memory

The present research also used the WMS IV and RMT to examine verbal and non-verbal memory capacity in all three groups. The means and percentile scores on Table 5.4 indicate that the confabulating and non-confabulating amnesia patients had deficits in both verbal and non-verbal memory. A further analysis of these results using One-way ANOVA showed that there were significant differences between the groups on all three WMS–IV immediate subtests: logical memory (F (2, 36) = 55.14, p<.001), verbal paired associates (F (2, 36) = 34.61, p<.001) and visual reproduction (F (2, 36) = 37.67, p<.001). Tukey post-hoc test revealed that the confabulating and non-confabulating groups underperformed on all three WMS-IV subtests compared with the healthy controls (p<.001). However, there were no significant differences between the confabulating and non-confabulating amnesia patients on these subtests. Furthermore, results showed significant differences between the groups on both of the RMT tests: Word Recognition (F (2, 36) = 15.55 p<.001) and Face Recognition F (2, 36) = 16.28, p<.001). The two patient groups again significantly underperformed on these tests compared with healthy controls: confabulating group (mean difference= 14.46, p<.001) and non-confabulating group (mean difference= 9.39, $p<.001$). However there were no significant differences between the confabulating and non-confabulating amnesia patients on this test.

Executive Functioning

The present research used the Hayling and Brixton tests to examine executive functioning in the three groups. An inspection of the means on Table 5.4 show that the confabulating and non-confabulating amnesia groups both underperformed on executive measures compared with healthy controls. Further analysis using one-way ANOVA revealed no significant difference between the three groups on the Hayling sentence completion test: F (2, 36) = 2.20, p=.13. This finding suggested that there were no significant differences between three groups on instigating a timed response. However, significant differences between the three groups were found on the Hayling sentence unconnected completion tests time score: F (2, 36) = 3.84, $p<.05$. A Tukey test showed that the confabulating amnesia group were slower to respond on this test compared with healthy controls: mean difference= 30.85, $p<.05$. However, this difference was not significant between the confabulating and non-confabulating groups. Significant differences between the three groups were also found on the Hayling sentence unconnected completion tests error score: F (2, 36) = 9.41, $p< .01$ The Tukey test also revealed that both amnesia groups produced more errors on the unconnected completion tests compared with healthy controls: confabulating group (mean difference=17.62, $p<.001$) and non-confabulating group (mean difference=11.69, $p<.05$). However, there were no significant differences between the confabulating and non-confabulating groups on this test (mean difference=5.92, $p<.34$). These findings showed that the confabulating group were slower to respond yet produced more errors. This finding suggested that the confabulating group had difficulties suppressing the prepotent response. In contrast, the non-confabulating group produced a time score that was not significantly different to healthy controls. This suggested that the non-confabulating patients were impulsive because they were faster to initiate a timed-response yet produced the same number of errors as the confabulating group. Finally, the ANOVA analysis also revealed significant difference between the three groups on the Brixton test: F (2, 36) = 17.65, $p<$ .001. The two amnesia groups significantly underperformed on this test compared with healthy controls: confabulating group (mean difference= 12.39, $p<.001$) and non-confabulating (mean difference= 9.92, $p<.001$). These findings indicated that these patients have difficulties identifying and following a rule compared with healthy controls.

5.3.2. Confabulation results

Results obtained from the confabulating and non-confabulating amnesia groups on the confabulation interview were analysed to examine the proportion of confabulatory answers produced using an independent samples t-test. Table 5.5 (below) shows the mean proportion of confabulatory answers produced on the Dalla Barba interview.

Table 5.5: <u>Confabulation Results:</u> Proportion of confabulatory answers in each section of the questionnaire expressed as means and standard deviations for the confabulating and non-confabulating groups.

Dalla Barba Confabulation Battery - UK Edition	Confabulating Group		Non-confabulating Group		Statistical Differences Between Groups
	Mean	SD	Mean	SD	t-test results
Confabulatory responses on personal semantic questions	.02	.03	.01	.02	*t* (20.9) = 1.05, *p*=.31
Confabulatory response on episodic questions	.56	.04	.07	.08	*t* (24) = 20.33, *p*< .001
Confabulatory responses on orientation questions	.16	.14	.05	.09	*t* (24) = 2.54, *p*< .05
Confabulatory responses on general semantic questions	.17	.13	.08	.11	*t* (24) = 1.89, *p*=.07
Confabulatory responses on 'I don't-know' semantic questions	.18	.12	.09	.16	*t* (24) = 1.53, *p*=.14
Confabulatory responses on 'I don't-know' episodic questions	.13	.11	.03	.04	*t* (15.7) = 3.26, *p*<.01
Total proportion of confabulations	.20	.03	.05	.04	*t* (24) = 12.04, *p*<.001

Statistical analysis using an independent-samples t-test showed that the confabulating group produced a higher proportion of confabulatory answers on this test compared with the non-confabulating group.

Furthermore, results showed that the confabulating group produced a significantly higher proportion of confabulatory answers compared with the non-confabulating group on the episodic questions and episodic "I-don't-know" questions. The confabulating group were also more disorientated in time and place compared with the non-confabulating group.

However, there were no significant differences between the two groups on the proportion of confabulatory answers produced on personal semantic questions, general semantic questions and semantic "I-don't-know" questions.

5.3.3. Results from the mood induction procedures

The scores on the Positive Affect Negative Affect Scale (PANAS) questionnaire were analysed in order to examine whether the video mood induction procedures induced relative mood changes.

A repeated measures ANOVA was carried out to analyse the dependent variable: participants' positive and negative mood ratings. Paired-sample t-tests were also carried out to examine participants' positive and negative mood scores in response to the two mood induction procedures.

The repeated measures ANOVA was carried out with Mood condition (positive and negative) and Mood-Rating-Type (positive and negative) as the with-in subject factors. Group was the between-participant factor (confabulating group, non-confabulating group and healthy controls). The dependent variable was the participants' mood ratings. Findings showed that there was no main effect of Group: F (1, 36) = .53, p=.59. However, there was a main effect of Mood condition: F (1, 36) = 47.99, p<.001 and a main effect of Mood-Rating-Type: F (1, 36) = 53.34, p<.001. There was also a significant two-way interaction between Mood-condition and Mood-Rating-Type: F (1, 36) = 476.54, p<.001. However, there was no significant three-way interaction between Mood condition, Mood-Rating-Type and Group: F (2, 36) = .81, p=.45. This suggested that the mood ratings were dependent on condition, but with no difference in this pattern between groups.

To confirm this, paired-samples t-tests were carried out to compare positive versus negative mood induction within each group. All groups that were administered the positive video induction procedure produced a significantly higher rating for positive mood: confabulating group (t (12) = 9.05, p<.001), non-confabulating amnesia group (t (12) = 9.85, p<.001) and healthy controls (t (12) = 13.26, p<.001).

For the negative video induction procedure, all groups produced a significantly higher rating for negative mood: confabulating group (t (12) = 6.63, p<.001), non-confabulating group (t (12) = 5.18, p<.001) and healthy controls (t (12) = 5.29, p<.001).

5.3.4. Results from the Semantic-Associates Procedures

Three separate repeated measures ANOVAs were used to analyse the three dependent variables: target words, critical distracters and unrelated intrusions. This analysis was used for the recall and recognition tests. The results for the recall test are described below. This is followed by the results for the recognition test.

5.3.4.1. Recall Test Results

Table 5.6 (below) shows means and standard deviations (SD) for the proportion of target words, critical distracters and unrelated distracters recalled between the three groups from the positive and negative mood conditions.

Table 5.6: <u>Recall Results:</u> Mean scores (SD) for the proportion of target words, critical distracters and unrelated intrusions produced in the recall test between the three groups.

Recall Test	Confabulating Group		Non-confabulating Group		Healthy Controls	
	Positive Condition	Negative Condition	Positive Condition	Negative Condition	Positive Condition	Negative Condition
Proportion of Target Words:						
Positive Target Words	.28 (.10)	.29 (.11)	.46 (.13)	.34 (.12)	.56 (.08)	.40 (.09)
Negative Target Words	.25 (.10)	.26 (.11)	.35 (.11)	.41 (.12)	.42 (.06)	.54 (.10)
Neutral Target Words	.27 (.12)	.24 (.09)	.37 (.12)	.34 (.14)	.42 (.06)	.41 (.07)
Proportion of Critical Distracters:						
Positive Critical Distracters	.19 (.33)	.12 (.22)	.27 (.26)	.12 (.22)	.15 (.24)	.19 (.25)
Negative Critical Distracters	.15 (.24)	.04 (.14)	.08 (.19)	.12 (.22)	.00 (.00)	.15 (.24)
Neutral Critical Distracters	.19 (.38)	.23 (.38)	.19 (.25)	.15 (.24)	.27 (.33)	.19 (.25)
Proportion of Unrelated Intrusions:						
Positive Unrelated Intrusions	.15 (.43)	.46 (.52)	.11 (.22)	.23 (.44)	.00 (.00)	.23 (.26)
Negative Unrelated Intrusions	.12 (.22)	.00 (.00)	.04 (.14)	.15 (.24)	.04 (.14)	.08 (.28)
Neutral Unrelated Intrusions	.15 (.32)	.23 (.44)	.15 (.24)	.04 (.14)	.19 (.33)	.00 (.00)

Recall Test Results for Target Words

A repeated measures ANOVA was used with Word-Category (positive, negative and neutral) and Mood condition (positive and negative) as the two within-participant factors and Group as the between-participant factor (confabulating group, non-confabulating group and healthy controls). The number of target words recalled was the dependent variable. There was a significant main effect of Group: F (2, 36) = 19.53, p<.001. There was no main effect of Mood condition: F (1, 36) = 1.59, p=.21. However there was a significant main effect of Word-category: F (2, 72) = 8.73, p<.01. There was no significant interaction between Group and Mood condition: F (2, 36) = .34, p=.72. There was also no interaction between Group and Word-category: F (4, 72) = .34, p=.27. However, there was a significant two-way interaction between Mood condition and Word-category: F (2, 72) = 25.49, p<.01. There was also a significant three-way interaction between Group, Word-category and Mood condition: F (4, 72) = 7.43, p<.001. These findings suggested that the groups differed in terms of the targets recalled between the positive and negative mood conditions.

Paired samples t-tests were carried out to further explore the two-way interaction between word-category and mood condition. Findings showed that overall, participants recalled significantly more positive targets in the positive condition compared with the negative condition: t (38) = 4.56, p<.001. In contrast, these participants recalled significantly more negative targets in the negative condition compared with the positive condition: t (38) = 3.41, p<.01. However there were no significant differences in the recall of neutral targets between the positive and negative mood conditions: t (38) = 1.11, p=.27. These findings suggested that participants generally recalled more information that was congruent to the mood state induced at the time of learning the studied list.

Paired samples t-tests were also used to examine whether there was a mood congruent effect in the three groups. In the positive mood condition, the confabulating group did not show a mood congruent bias. These patients showed no significant difference in the proportion of positive, negative and neutral targets recalled. In contrast, the non-confabulating patients and healthy controls recalled significantly more positive targets in comparison to the negative and neutral targets (p<.05). In the negative mood condition, the confabulating group showed no significant differences in the proportion of positive, negative and neutral targets recalled. The non-confabulating amnesia group in the negative mood condition did not show the mood congruent bias. This group showed no significant difference in the recall of negative and neutral targets (t (38) = 1.98, p=.07). However, healthy controls showed this bias and recalled significantly more negative targets compared with positive and neutral targets (p<.01). These findings suggested that, in contrast to non-confabulating patients and healthy controls, mood in confabulating patients did not influence the recall of target words.

A Tukey post-hoc analysis was then carried out to further explore the significant three-way interaction, in relation to group differences. Findings showed that the confabulating group recalled a significantly lower proportion of targets across all three word categories in the positive mood condition compared with the non-confabulating group (p<.05) and healthy controls (p<.01). In the negative mood condition, the confabulating group recalled a significantly lower proportion of positive targets compared with healthy controls (mean difference=.11, $p<.05$). However, there were no significant differences between the confabulating and non-confabulating group on the recall of positive targets in the negative condition (mean difference=.05, $p=.44$). This test also revealed that the confabulating group recalled a significantly lower proportion of negative and neutral targets in the negative condition compared with the two comparison groups: healthy controls ($p<.001$) and non-confabulating group ($p<.05$). These findings showed that negative mood reduced the recall of positive information in both confabulating and non-confabulating patients. Overall, patients in the confabulating group had difficulties recalling target words in both positive and negative mood conditions compared with the two comparison groups.

Recall Test Results for Critical Distracters

A repeated measures ANOVA was used to examine the number of critical distracters recalled with Word-Category (positive, negative and neutral) and Mood condition (positive and negative) as the two within-participant factors. Group was the between-participant factor (confabulating group, non-confabulating group and healthy controls). Findings showed that there was no significant main effect of Group: F (2, 36) = .01, $p=.99$. There was also no main effect of Mood condition: F (1, 36) = .27, $p=.61$. However, there was a significant main effect of Word-category: F (2, 72) = 6.73, $p<.01$. There was no significant two-way interaction between Group and Mood condition: F (2, 36) = .53, $p=.60$. There was no significant two-way interaction between Group and Word-category: F (4, 72) = .42, $p=.80$. There was no significant two-way interaction between Mood condition and Word-category: F (2, 72) = .71, $p=.50$. There was also no significant three-way interaction between Group, Word-category and Mood condition: *F* (4, 72) = 1.33, *p*=.27. These findings suggested that there was no significant difference between the groups on the proportion of critical distracters falsely recalled across the word categories. However, these findings also suggested that there were differences in the overall proportion of critical distracters falsely recalled across the word categories.

The significant main effect of word-category was further explored using paired samples t-tests. Findings showed that overall, participants falsely recalled a significantly lower proportion of negative critical distracters compared with the other two categories: positive critical distracters (t (38) = 2.49, p<.05) and neutral critical distracters (t (38) = 4.22, p<.001). However, there were no significant differences in false recall between the positive and neutral critical distracters (t (38) = .93, p=.36). These findings suggested that participants are less susceptive to negative critical distracters compared with positive and neutral critical distracters.

<u>Recall Test Results for Unrelated Intrusions</u>

Figures 5.1 and 5.2 reflect insignificant weak trends. These figures illustrate that the confabulating group in the positive and negative mood condition falsely recalled a higher proportion of positive unrelated intrusions compared with negative and neutral intrusions. In both mood conditions, the confabulating group also falsely recalled a higher proportion of positive intrusions compared with the non-confabulating group and healthy controls.

Figure 5.1: False Recall of Unrelated Intrusions in the Positive Mood Condition: Mean proportion of unrelated intrusions from the positive, negative and neutral categories falsely recalled across the three groups of participants: 13 confabulating amnesia patients, 13 non-confabulating amnesia patients and 13 healthy controls.

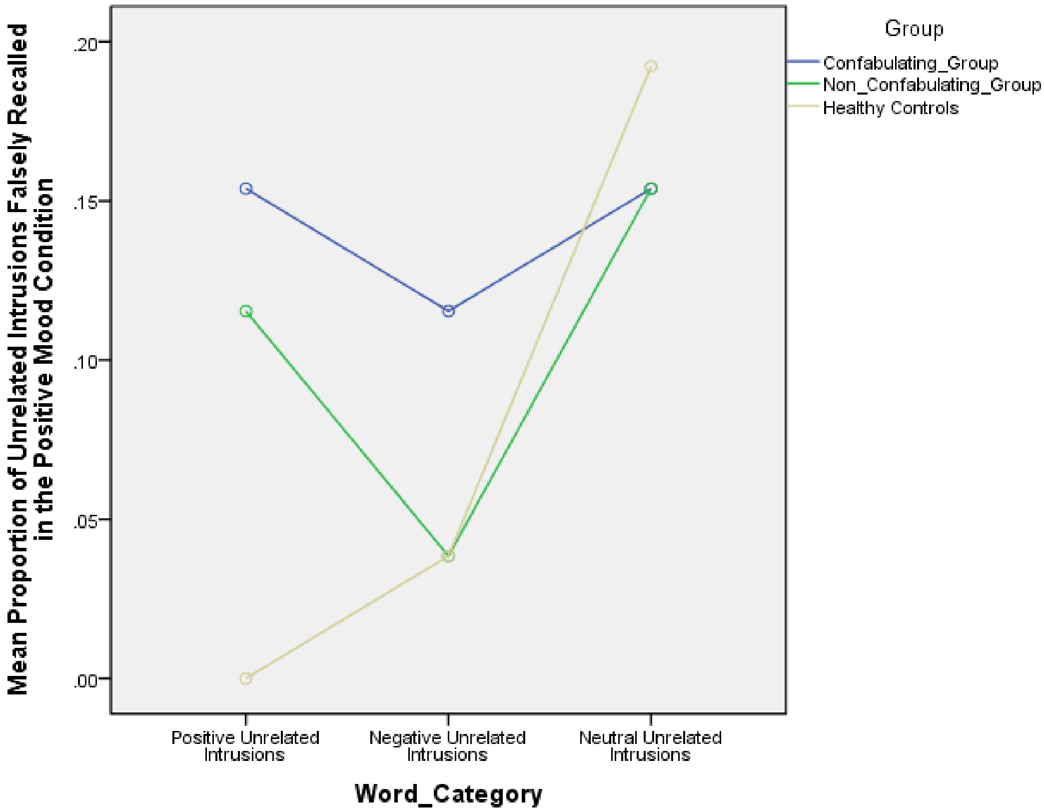
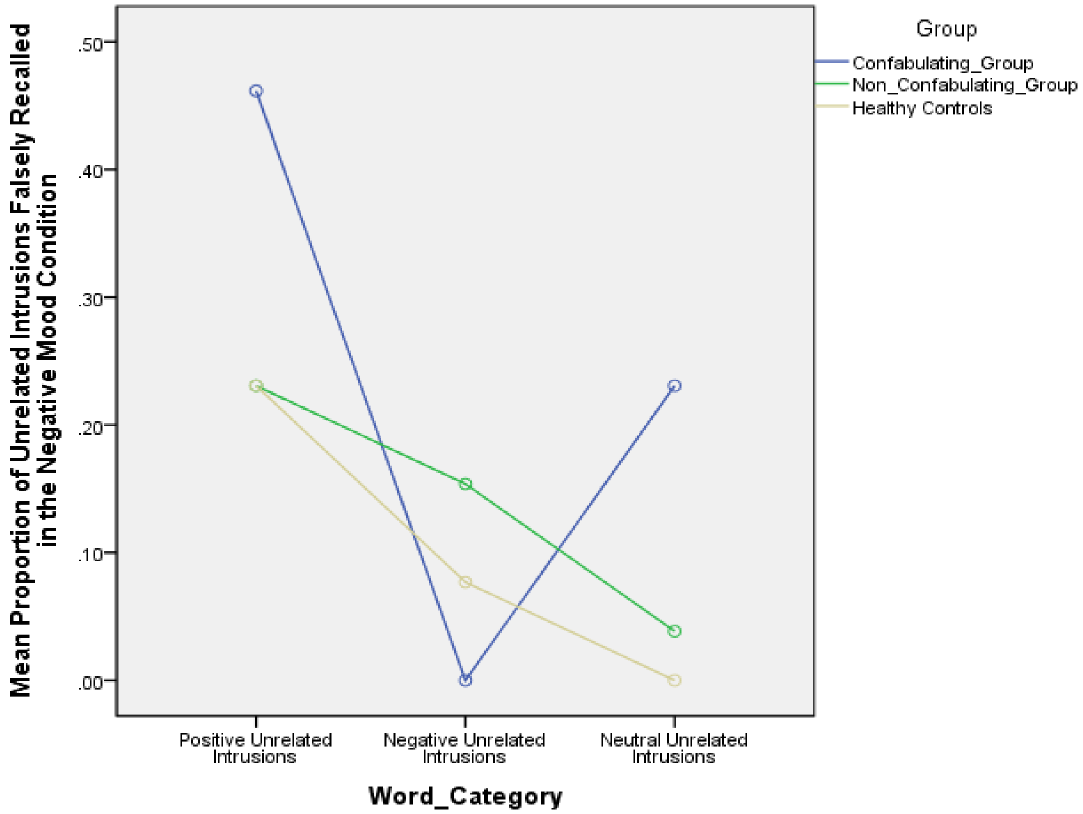


Figure 5.2: False Recall of Unrelated Intrusions in the Negative Mood Condition: Mean proportion of unrelated intrusions from the positive, negative and neutral categories falsely recalled across the three groups of participants: 13 confabulating amnesia patients, 13 non-confabulating amnesia patients and 13 healthy controls.



A repeated measures ANOVA was used to examine the proportion of unrelated intrusions recalled with Word-Category (positive, negative and neutral) and Mood condition (positive and negative) as the two within-participant factors. Group was the between-participant factor (confabulating group, non-confabulating group and healthy controls). Findings showed no significant main effect of Group: *F* (2, 36) = 1.03, *p*=.37. There was also no main effect of Mood condition: *F* (1, 36) = 2.60, *p*=.12. However there was a significant main effect of Word-category: *F* (2, 72) = 4.84, *p*<.05. There was no significant interaction between Group and Mood condition: *F* (2, 36) = .39, *p*=.69. There was no significant interaction between Group and Word-category: *F* (4, 72) = 1.20, *p*=.32. However, there was a significant two-way interaction between Mood condition and Word-category: *F* (2, 72) = 7.98, *p*<.01. However, there was no significant three-way interaction between Group, Word-category and Mood condition: *F* (4, 72) = 2.27, *p*=.07. These findings suggested that there were significant differences between the three groups in terms of the recall of unrelated intrusions. However, there was no significant difference between the two mood conditions in terms of the proportion of unrelated intrusions falsely recalled across the word categories.

The significant main effect of Word-category was analysed further using paired-samples t-tests. Findings showed that overall participants falsely recalled significantly more positive unrelated intrusions compared with negative unrelated intrusions: (*t* (38) = 2.80, *p*<.01). However, there were no significant differences in false recall between positive and neutral unrelated intrusions: (*t* (38) = 1.87, *p*=.07). There were also no significant differences in false recall between negative and neutral unrelated intrusions: (*t* (38) = 1.42, *p*=.16).

Paired-samples t-tests were also carried out to explore the two-way interaction between word-category and mood condition. Findings showed that overall, participants recalled significantly more positive unrelated intrusions in the positive condition compared with the negative condition: *t* (38) = 3.20, *p*<.01. However, there were no significant differences in false recall of negative unrelated intrusions between the positive and negative mood conditions: *t* (38)

= .30, *p*=.77. Similarly, there were no significant differences in false recall of neutral unrelated intrusions between the positive and negative mood conditions: *t* (38) = 1.53, *p*=.14. These findings suggested that only positive mood enhanced the false recall of mood-congruent unrelated intrusions.

<u>Summary of Recall Results</u>

Results from the recall test showed that the confabulating and non-confabulating groups recalled a significantly lower proportion of target words compared with healthy controls. Results also showed that both non-confabulating patients and healthy controls recalled a higher proportion of targets that matched the mood state induced at the time of learning. This mood congruent bias was not found in the confabulating group. These findings suggest that mood in confabulating patients does not influence veridical recall. Also, there was no significant difference between the three groups in terms of the proportion of unrelated intrusions recalled in both the positive and negative mood conditions. This indicated that the confabulating group did not show the positive emotional bias in the recall of positive intrusions.

5.3.4.2. Recognition Test

Table 5.6 (below) shows means for the proportion of target words, critical distracters and unrelated distracters between the three groups. The table shows the recall results from the positive and negative mood conditions.

Table 5.7: Recognition Results: Mean scores (standard deviations) for the proportion of target words, critical distracters and unrelated intrusions produced in the recognition test between the three participant groups.

Recognition Test	Confabulating Group		Non-confabulating Group		Healthy Controls	
	Positive Condition	Negative Condition	Positive Condition	Negative Condition	Positive Condition	Negative Condition
Proportion of Target Words :						
Positive Target Words	.70 (.24)	.68 (.23)	.81 (.20)	.69 (.20)	.93 (.08)	.65 (.19)
Negative Target Words	.64 (.17)	.74 (.20)	.62 (.21)	.89 (.15)	.60 (.12)	.91 (.09)
Neutral Target Words	.56 (.20)	71 (.25)	.52 (.14)	.60 (.21)	.52 (.21)	.65 (.18)
Proportion of Critical Distracters:						
Positive Critical Distracters	.31 (.43)	.69 (.33)	.46 (.43)	.42 (.40)	.69 (.33)	.42 (.19)
Negative Critical Distracters	.35 (.43)	.42 (.34)	.38 (.36)	.50 (.46)	.42 (.34)	.58 (.40)
Neutral Critical Distracters	.31 (.38)	.50 (.35)	.42 (.34)	.35 (.38)	.42 (.34)	.35 (.32)
Proportion of Unrelated Intrusions:						
Positive Unrelated Intrusions	.30 (.28)	.48 (.29)	.21 (.21)	.10 (.21)	.07 (.10)	.06 (.08)
Negative Unrelated Intrusions	.10 (.15)	.20 (.21)	.10 (.17)	.24 (.24)	.01 (.04)	.01 (.04)
Neutral Unrelated Intrusions	.11 (.18)	.15 (.14)	.05 (.07)	.08 (.10)	.04 (.08)	.04 (.08)

Recognition Test Results for Target Words

A repeated measure ANOVA was used with Word-category (positive, negative and neutral) and Mood condition (positive and negative) as the two within-participant factors and Group as the between-participant factor (confabulating group, non-confabulating group and healthy controls). The number of target words recognised was the dependent variable. There was no significant main effect of Group: F (2, 36) = .53, p=.59. However, there was a main effect of Mood condition: F (1, 36) = 6.31, p<.05 and Word-category: F (2, 72) = 18.04, p<.001. There was no interaction between Group and Mood condition: F (2, 36) = .09, p=.92. There was also no interaction between Group and Word-category: F (4, 72) = 1.90, p=.12. However, there was a significant two-way interaction between Mood condition and Word-category: F (2, 72) = 22.03, p<.001. There was also a significant three-way interaction between Group, Word-category and Mood condition: F (4, 72) = 2.89, p<.05. These findings indicated that mood within the groups influenced the proportion of target words recognised across the word categories.

The significant main effect of Word-category was examined using paired samples t-tests. Findings showed that overall, participants recognised more target words from the two emotional categories compared with the neutral category: positive category (t (38) = 4.90, p<.001) and negative category (t (38) = 5.32, p<.001). However, there were no significant differences in the recognition of target words between the positive and negative word categories (t (38) = .39, p=.70). These findings are consistent with the results from study 1 and suggested that affective information is easier to retrieve compared with neutral information.

The significant main effect of Mood condition was also further inspected using paired samples t-tests. Overall, participants recognised significantly more target words in the negative mood condition compared with the positive mood condition (t (38) = 2.61, p<.05).

Paired samples t-tests were carried out to examine whether there was a mood congruent bias in the three groups. In the positive mood condition, the two patient groups recognised significantly more positive targets than neutral targets: confabulating group (t (38) = 2.11, p=.05), non-confabulating group (t (38) = 3.45, p<.01). There were no significant differences in the proportion of positive and negative targets recognized in the confabulating and non-confabulating groups. In contrast, the healthy controls recognised significantly more positive targets in comparison to the negative and neutral targets (p<.001). In the negative mood condition, the confabulating group did not show a mood congruent bias. In contrast, the two comparison groups showed a mood congruent bias and recognised significantly more negative targets compared with positive and neutral targets (p<.001). These findings are consistent with the results from the recall test and indicated that mood in confabulating patients does not enhance veridical recognition of mood-congruent information.

The same measure was used to analyse the two-way interaction between Word-category and Mood condition. Findings showed that overall participants recognised significantly more positive targets in the positive condition compared with the negative condition: t (38) = 2.96, p<.01. Similarly, these participants recognised significantly more negative targets in the negative condition compared with the positive condition: t (38) = 6.03, p<.001. Finally, participants recognised more neutral targets in the negative condition compared with the positive condition: t (38) = 2.73, p<.05.

A Tukey post-hoc analysis was carried out to examine the significant three-way interaction using one-way ANOVA. Findings showed that there were significant differences between the groups on positive target recognition in the positive mood condition: F (2, 36) = 4.64, p<.05. A Tukey test revealed that the confabulating group recognised a significantly lower proportion of positive targets in the positive condition compared with healthy controls (mean difference= .22, p<.05). However, there was no significant difference on positive target recognition in the positive condition between the confabulating and non-confabulating groups (mean difference=.10, p=.33). The one-way ANOVA analysis also showed significant differences between the groups on negative target recognition in the negative mood condition: F (2, 36) = 4.52, p<.05. The Tukey test revealed that the confabulating group recognised a significantly lower proportion of negative targets in the negative condition compared with the non-confabulating group (mean difference=.14, p=.05) and healthy controls (mean difference=.16, p<.05). There were no significant differences found between the non-confabulating group and healthy controls in the negative mood condition. These findings showed that the confabulating group had more difficulties recognising target words compared with the two comparison groups. Mood in the confabulating group did not enhance the retrieval of mood-congruent information.

Recognition Test Results for Critical Distracters

A repeated measures ANOVA was used to examine the proportion of critical distracters falsely recognised with Word-category (positive, negative and neutral) and Mood condition (positive and negative) as the two within-participant factors. Group was the between-participant factor (confabulating group, non-confabulating group and healthy controls). Findings showed no significant main effect of Group: F (2, 36) = .34, p=.72 and no main effect of Mood condition: F (1, 36) = .71, p=.41. There was also no significant main effect of Word-category: F (2, 72) = 2.70, p=.07. There was no significant interaction between Group and Mood Condition: F (2, 36) = 1.96, p=.16. There was also no interaction effect between Group and Word-category: F (4, 72) = .57, p=.68. There was no significant two-way interaction between Mood condition and Word-category: F (2, 72) = .62, p=.54. There was also no significant three-way interaction between Group, Word-category and Mood condition: F (4, 72) = 2.30, p=.07. This indicates that there were no differences in the proportion of critical distracters falsely recognised between the mood conditions across the groups.

Recognition Test Results for Unrelated Intrusions

Figures 5.3 and 5.4 illustrate that the confabulating group, in both the positive and negative mood conditions, falsely recognised a high proportion of positive unrelated intrusions compared with the negative and neutral unrelated intrusions. In both mood conditions, the confabulating group falsely recognised a higher proportion of positive intrusions compared with non-confabulating patients and healthy controls. However further analysis using repeated measures ANOVA confirmed that only the findings from the negative mood condition approached a statistical significance. This indicated that confabulating patients in whom a negative mood was induced falsely recognised a significantly higher proportion of positive unrelated intrusions compared with the comparison groups.

Figure 5.3: False Recognition of Unrelated Intrusions in Positive Mood Condition: Mean proportion of unrelated intrusions from the positive, negative and neutral categories falsely recognised by the three groups of participants: 13 confabulating amnesia patients, 13 non-confabulating amnesia patients and 13 healthy controls.

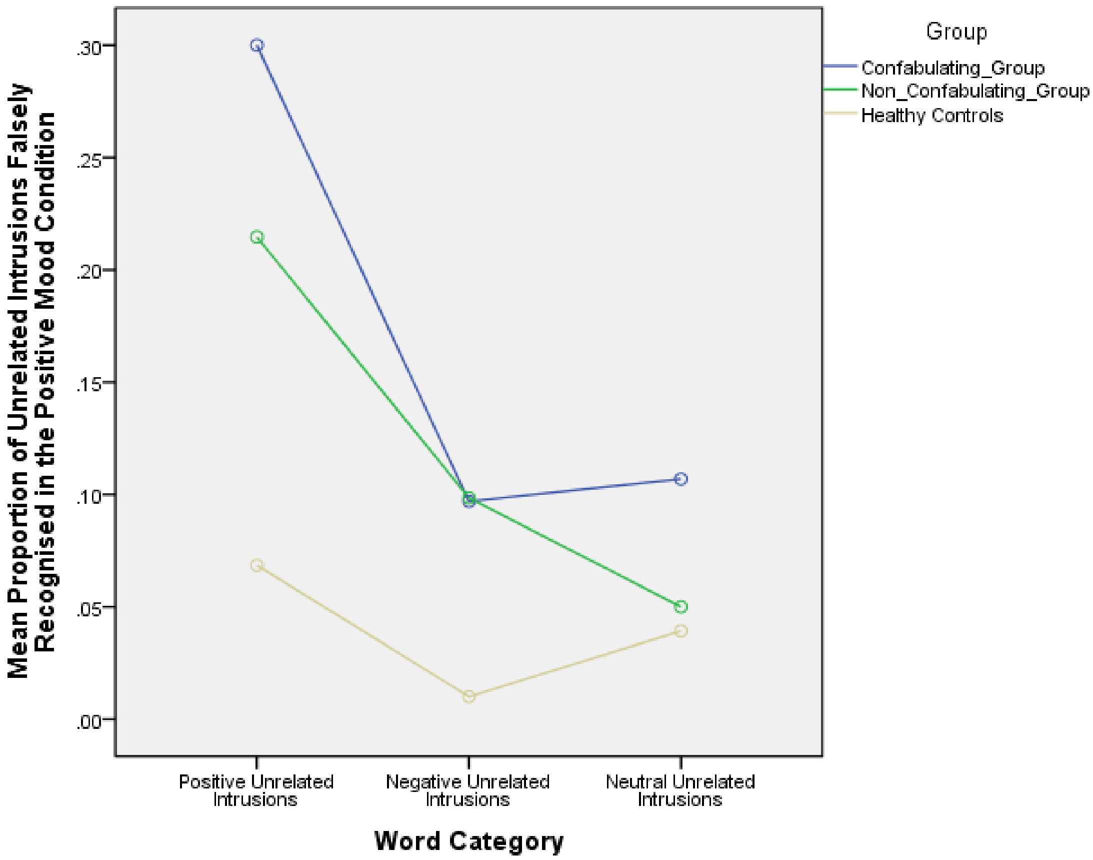
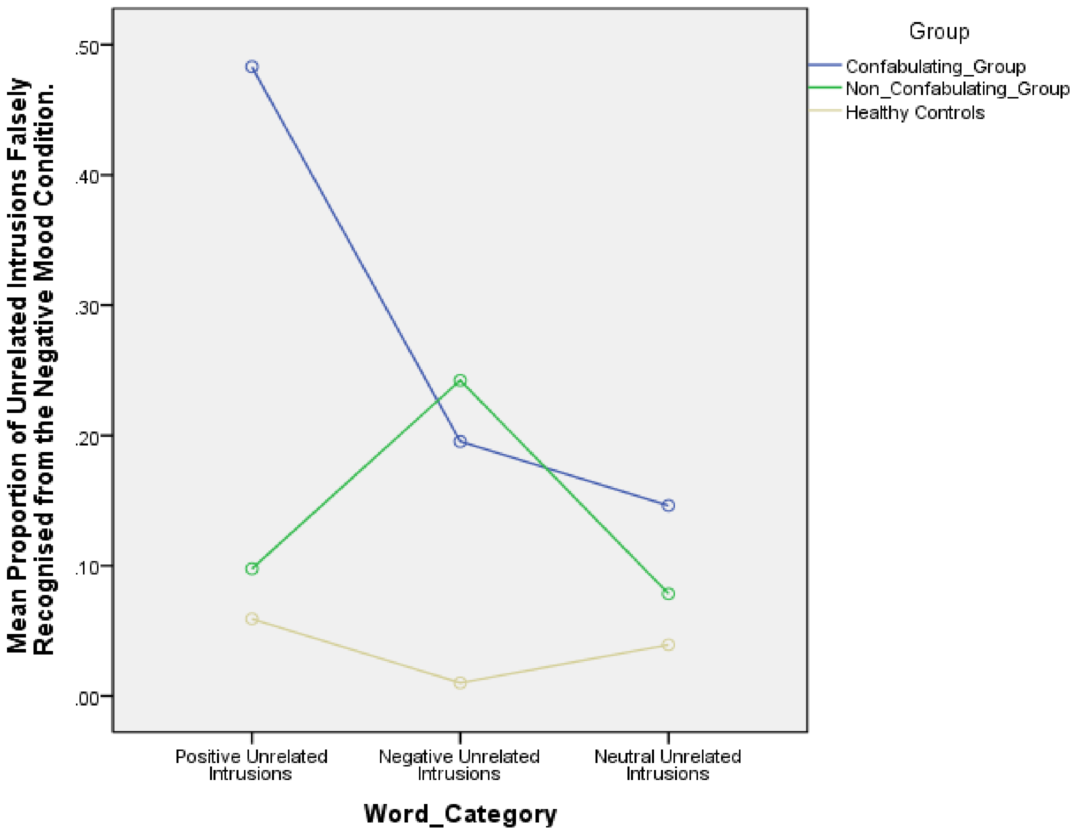


Figure 5.4: False Recognition of Unrelated Intrusions in Negative Mood Condition: Mean proportion of unrelated intrusions from the positive, negative and neutral categories falsely recognised by the three groups of participants: 13 confabulating amnesia patients, 13 non-confabulating amnesia patients and 13 healthy controls.



A repeated measures ANOVA was carried out with Word-category (positive, negative and neutral) and Mood condition (positive and negative) as the two within-participant factors and Group was the between-participant factor (confabulating group, non-confabulating group and healthy controls). The dependent variable was the proportion of unrelated intrusions falsely recognised. Findings showed that there was a main effect of Group: F (2, 36) = 10.21, p<.001 and a main effect of Word-category: F (2, 72) = 14.13, p<.001. However, there was no main effect of Mood condition: F (1, 36) = 3.73, p=.06.

There was no two-way interaction between Group and Mood condition: F (2, 36) = 2.54, p=.09. There was also no two-way interaction between Mood condition and Word-category: F (2, 72) = 1.57, p=.22. However, there was a two-way interaction between Word-category and Group: F (4, 72) = 6.86, p<.001. There was also a three-way interaction between Group, Word-category and Mood condition: F (4, 72) = 4.07, p<.01. These findings suggested that there were significant differences in the proportion of unrelated intrusions between the positive and negative mood conditions across the groups.

The significant main effect of Word-category was analysed using paired samples t-tests. Overall, participants falsely recognised more positive unrelated intrusions compared with the other two word categories: negative category (t (38) = 2.84, p<.01) and neutral category (t (38) = 4.35, p<.001). However, there were no significant differences in the recognition of unrelated intrusions between the negative and neutral word categories (t (38) = 1.49, p=.14). These findings suggested that there was a general positive bias in the false recognition of unrelated intrusions.

The same measure was used to examine the proportion of positive unrelated intrusions falsely recognised between the positive and negative mood conditions. The confabulating group falsely recognised significantly more positive intrusions in the negative mood condition compared with the positive mood condition: t (12) = 2.52, p<.05. This finding was not observed in the non-confabulating group (t (12) = 1.35, p=.20) and healthy controls (t (12) = .25, p=.80). These findings indicated that negative mood in the confabulating group enhanced the false recognition of positive unrelated intrusions. In addition, findings showed that confabulating patients falsely recognised a significantly higher proportion of unrelated intrusions in the negative mood condition compared with the positive mood condition (t (12) = 2.66, p<.05). These findings were not statistically significant in the non-confabulating group and healthy controls.

A one-way ANOVA was carried out to explore the two-way interaction between Word-category and Group. Findings showed that there were significant differences between the groups on the false recognition of positive unrelated intrusions: F (2, 36) = 12.75, p<.001. A Tukey test revealed that the confabulating group falsely recognised significantly more positive unrelated intrusions compared with the two comparison groups: non-confabulating patients (mean difference=.24, p<.01) and healthy controls (mean difference=.33 p<.001). These findings indicated that only the confabulating group showed a positive emotional bias in the false recognition of unrelated intrusions.

The one-way ANOVA also showed that there were significant differences between the groups on the false recognition of negative unrelated intrusions: F (2, 36) = 4.94, p<.05. The Tukey test revealed that the two amnesia groups falsely recognised significantly more negative unrelated intrusions compared with healthy controls: confabulating patients (mean difference=.14, p<.05) and non-confabulating patients (mean difference=.16, p<.05). However, there were no significant differences between the confabulating and non-confabulating groups on the overall false recognition of negative unrelated intrusions (mean difference=.02, p=.90).

A one-way ANOVA showed significant differences between the groups on the overall false recognition of neutral unrelated intrusions: $F\ (2, 36) = 3.33$, $p<.05$. The Tukey test showed that the confabulating group falsely recognised significantly more neutral unrelated intrusions compared with healthy controls (mean difference=.09, $p<.05$). However, this difference was not significant between the confabulating and non-confabulating groups (mean difference=.06, $p=.19$). No significant differences were found between the non-confabulating group and healthy controls (mean difference=.02, $p=.76$). This indicated that confabulating patients generally recognised more unrelated intrusions across the word categories compared with healthy controls.

The three-way interaction was further explored using one-way ANOVA. Findings showed that there were significant differences between the groups on positive unrelated intrusions falsely recognised in the positive mood condition: $F\ (2, 36) = 4.05$, $p<.05$. A Tukey tests revealed that the confabulating group recognised significantly more positive unrelated intrusions in the positive mood condition compared with healthy controls (mean difference=.23, $p<.05$). However, this difference was not significant between the confabulating and non-confabulating patients (mean difference=.09, $p=.56$). There was also no significant difference between the non-confabulating patients and healthy controls (mean difference=.15, $p=.19$).

The one-way ANOVA test also revealed significant differences between the groups on positive unrelated intrusions falsely recognised in the negative mood condition: $F\ (2, 36) = 15.89$, $p<.001$. The Tukey test indicated that the confabulating group also recognised significantly more positive unrelated intrusions in the negative mood condition compared with the two comparison groups: non-confabulating patients (mean difference=.39, $p<.001$) and healthy controls (mean difference=.42, $p<.001$). There was no significant difference between the non-confabulating patients and healthy controls (mean difference=.04, $p=.89$). These findings suggest that negative mood in confabulating patients induces a positive emotional bias in false recognition.

Finally, the ANOVA analysis also showed significant differences between the three groups on the negative unrelated intrusions falsely recognised in the negative mood condition: F (2, 36) = 5.67, $p<.01$. The two amnesia groups falsely recognised significantly more negative unrelated intrusions in the negative mood condition compared with the healthy controls: confabulating patients (mean difference=.19, $p<.05$) and non-confabulating patients (mean difference=.23, $p<.01$). However, there were no significant differences in the false recognition of negative unrelated intrusions in the negative condition between the confabulating and non-confabulating amnesia groups (mean difference=.05, $p=.80$).

Summary of Recognition Results

Findings show that the confabulating and non-confabulating groups recognised a significantly lower proportion of target words and critical distracters compared with healthy controls. The non-confabulating group and healthy controls also showed a mood congruent bias in the recognition of target words. This memory bias was not found in the confabulating group. However, confabulating patients showed a positive emotional bias in the false recognition of unrelated intrusions. These patients falsely recognised a significantly higher proportion of positive intrusions in the negative mood condition compared with the positive mood condition.

Study 3: Signal Detection Analysis

Signal detection analyses were carried out using rates of endorsements of target words (hit rate) and unrelated intrusions (false alarms) for each of the three word categories (positive, negative and neutral) in the negative mood condition. This analysis was not carried out for the positive mood condition as there were no significant differences between the confabulating and non-confabulating groups on the proportion of positive unrelated intrusions.

Signal Detection Analysis for the Positive Word-Category

The finding that confabulating patients in the negative mood condition falsely recognised a higher proportion of positive intrusions compared with non-confabulating patients and healthy controls was further explored. This analysis used positive targets as hit rates and positive unrelated intrusions as false alarms. The analysis creates measure of memory strength (d') and decision bias (B_D''). Here, higher d' scores mean stronger memory and higher B_D'' estimates mean a more conservative response criterion. Table 5.8 (below) shows that the confabulating group had lower d' and B_D'' values compared with the non-confabulating group and healthy controls. This was confirmed using an ANOVA which showed that there were significant differences between the groups on d' scores: F (2, 36) = 32.75, p<.001 and also on B_D'' estimates: F (2, 36) = 6.19, p=.05.

Table 5.8 Signal detection Analysis: Measures of Memory Strength (d') and response bias (B_D") comparing positive targets with positive unrelated intrusions in the negative mood condition between the three groups.

Signal Detection Analysis – Positive Hit Rate Compared with Positive Intrusions.	Signal Detection (Memory Strength)	Beta (Decision Bias)
	d'	B_D"
Confabulating Group	.59	0.01
Non-confabulating Group	1.80	0.65
Healthy Controls	1.79	0.73

A post hoc Tukey test showed that the confabulating group had a significantly lower memory strength compared with the non-confabulating group (mean difference = 1.21, p<.001) and healthy controls (mean difference = 1.20, p<.001. However, there were no significant differences between the non-confabulating group and healthy controls in terms of memory strength (mean difference = .01, p=.99).

The Tukey test also showed that, in contrast to the results from study 1, B_D" was significantly lower in the confabulating group compared with the non-confabulating group (mean difference = .64, p<.05) and healthy controls (mean difference = .72, p<.01). No significant differences were found between the non-confabulating group and healthy controls on this measure (mean difference = .08, p=.93).

Signal Detection Analysis for the Negative Word-Category

Signal detection analysis using rates of endorsement of negative targets and negative intrusions showed significant differences between the three groups. The two amnesia groups had significantly lower d prime scores compared with healthy controls: confabulating group (mean differences = .1.12, p<.001) and non-confabulating group (mean differences = .79, p<.01). However, there were no significant d prime differences between the confabulating and non-confabulating groups (mean differences = .31, p=.30). In addition, no significant differences were found between the three groups in terms of response bias: F (2, 36) = 2.20, p=.13.

Signal Detection Analysis for the Neutral Word-Category

Signal detection analysis using rates of endorsement of neutral targets and neutral intrusions showed no significant differences between the three groups in terms of memory strength: F (2, 36) = .47, p=.63. However, differences were found between the three groups in terms of response bias: F (2, 36) = 4.09, p<.05. This showed that the confabulating group had a significantly lower B_D" estimate compared with healthy controls (mean differences = .56, p<.05). However, there were no significant differences between the confabulating and non-confabulating groups on this measure (mean differences = .41, p=.12).

Summary of Signal Detection Results

The results from the positive category showed that the confabulating group had a significantly lower memory strength compared with the non-confabulating group and healthy controls. These results also showed that the confabulating group used a more liberal criterion compared with the two comparison groups. On this basis, the current findings suggested that there may be two factors contributing to the positive emotional bias in confabulation: lower memory strength and liberal responding. In confabulating patients, weak memory for positive information may have reduced their ability to distinguish positive targets from positive intrusions. A liberal response criterion may have also biased confabulating patients to respond ‘yes’ to positive unrelated intrusions.

Findings from the neutral category show that although the three groups did not differ in terms of memory strength, both confabulating and non-confabulating patients used a more liberal criterion. This indicated that the two amnesia groups produced more ‘yes’ responses to neutral unrelated intrusions than healthy controls. Stanislaw and Todorov (1999) argued that a liberal criterion can sometimes produce more ‘yes’ responses to *both* unrelated intrusions (false alarms) and target words (hit rate). However, as these results are from the neutral category, it is unclear whether these findings have a clinical significance.

5.4. Discussion

Fotopoulou and colleagues (2008a) found a correlation between mood and the positive emotional bias in confabulation. However, subsequent studies failed to replicate this finding and the emotional triggers of confabulation remain unclear. The present research is the first to examine whether low mood influences the emotional content of confabulation using an affective semantic-associates procedure. This study is also the first to use mood induction procedures to induce confabulating patients into positive and negative mood sates.

To summarize, the findings from this study suggested the following:

1) The positive video mood induction procedure induced a higher positive mood rating in all three groups. Similarly, the negative video mood induction procedure induced a higher negative mood rating in all three groups.

2) The confabulating patients did not show a mood congruent bias for target words in both the positive and negative mood condition. In contrast, the non-confabulating amnesia patients and healthy controls showed this bias and correctly recognised more words that were congruent to the induced mood state.

3) All three groups showed no mood congruent biases in the false recall and false recognition of critical distracters.

4) Confabulating patients falsely recognised a higher proportion of positive unrelated intrusions in the negative mood condition compared with the positive mood condition.

5) Confabulating patients in the negative mood condition falsely recognised more positive unrelated intrusions compared with non-confabulating amnesia patients and healthy controls.

6) The confabulating patients falsely recognised more positive unrelated intrusions in the positive mood condition compared with healthy controls but not when compared with the non-confabulating patients.

Video mood induction procedures have been shown to induce reliable mood states in both older adults and Alzheimer's patients (Kunzmann and Gruhn, 2005; Mograbi et al., 2012). The present study found that this mood induction procedure successfully induced participants into the proposed mood states. Participants presented with the British comedy video clip reported a higher rating for positive mood. In contrast, these participants reported a higher rating for negative mood following the presentation of the terminal cancer video clip.

The effect of mood on recall has been studied over time in laboratory settings using mood induction procedures (Bower et al., 1981; Perrig's et al., 1988, Velten et al., 1968). Some studies provided evidence of the mood congruent effect and showed that healthy participants recalled more affective information that matched their mood state. These studies suggested that emotions play a major role in information processing (Bower et al., 1981).

Subsequently, Ruci and colleagues (2009) examined the effects of mood on false memories using affective lists from Roediger and colleagues (2001). They found that healthy participants who simulated positive emotions falsely recognised more positive critical distracters. Similarly, participants who simulated negative emotions falsely recognised more negative critical distracters. In the present study, all three groups of participants did not show mood congruent biases in the false recall and false recognition of critical distracters. However, a mood congruent bias was found in the recall and recognition of target words in both non-confabulating patients and healthy controls. These two groups falsely recalled more target words from the two emotional categories (positive vs. negative) that were congruent to the mood induced during the study phase. Confabulating patients did not show this mood congruent bias in the recall and recognition of target words. This novel finding indicated that confabulating patients may have a deficit in the processing of emotional material.

The present study provides a novel insight into confabulation by introducing an affective semantic-associates procedure to examine emotional biases in confabulating patients. Although confabulating patients in a negative mood state falsely recognised a high proportion of unrelated intrusions, this positive bias was not observed in the false recognition of critical distracters. Based on the results from study 2, it is possible that confabulating patients do not show biases in the false recognition of critical distracters because these items are often rejected as a consequence of degraded gist memory in amnesia.

The present study found that confabulating patients in a negative mood state falsely recognised a higher proportion of positive intrusions compared with when these patients were induced to a positive mood. This finding indicated that negative mood increases the positive bias in confabulation. Furthermore, negative mood significantly increased the overall rate of false recognition in confabulating patients. This finding suggested that confabulating patients that are clinically depressed are more likely to produce confabulations, particularly ones with pleasant content. In addition, these results can be explained using Fotopoulou's theory of confabulation as a defensive mechanism. One possibility is that negative mood in the present study may have been detected as a threat by the confabulating patients. Consequently, these patients' unconsciously produced more positive intrusions in order to protect their well-being against an unpleasant situation. However, this theory does not explain why the confabulating patients in the positive mood condition showed the positive emotional bias when compared with healthy controls.

Findings obtained from the positive mood condition showed that there were no significant differences in the proportion of positive intrusions produced between the confabulating and non-confabulating amnesia patients. However, the confabulating patients produced more positive intrusions in the positive mood condition compared with healthy controls. This difference was not observed in non-confabulating patients and healthy controls. Therefore, although confabulating patients showed an increased positive bias when induced to a negative mood state, they still produced more positive intrusions in the positive mood condition compared with healthy controls. This indicated that the positive emotional bias in confabulation may not necessarily have a defensive function.

This finding is explained in terms of two aspects: Firstly, according to the motivational perspective, emotional mechanisms give rise to confabulations as a consequence of poor executive control. Secondly, previous studies have shown an association between depressed mood and memory deficits (Burt et al., 1995; Kizilbash et al., 2002). Based on these aspects, a possible explanation for the present finding is that negative mood in confabulation may be enhancing the positive bias by causing a further strain on memory and executive processes.

Consistent with the findings from study 1, the positive bias in confabulating patients was *only* observed in false recognition. One possible explanation for this finding is proposed in relation to the delayed recognition test. The nature of the semantic-associates procedure is that the recall test is administered immediately after the study phase, whereas the recognition test is administered after the recall test has been completed for all 9 lists. Therefore, the delayed recognition test may have weakened memory in the confabulating group and consequently increased the false recognition of positive unrelated intrusions. A comparison of figures 5.2 and 5.4 show that both false recall and false recognition of unrelated intrusions display a similar pattern of results. The confabulating group in a negative mood state recalled and recognised more positive intrusions compared with the two comparison groups. It is postulated that confabulating patients may falsely recall significantly more positive intrusions if the recall test was delayed. As the present findings showed a positive bias *only* in false recognition, the semantic-associates procedure has to be regarded as a weak model of confabulation. If futures studies match the delay in recall and recognition testing and find a positive bias in response to both tests, the findings from the semantic-associates procedure would then provide stronger evidence that emotional mechanisms are involved in confabulations.

Another limitation of the current study is that a signal detection analysis on the false recognition of positive intrusions showed that the three groups differed significantly in terms of memory strength and response criterion. This indicated that confabulating patients tendency to falsely recognise more positive unrelated intrusions may be because their memory strength for positive material is significantly weaker compared with that of non-confabulating patients and healthy controls. Therefore, the positive bias in the content of confabulation may be a consequence of weak memory rather than emotional factors. To overcome this limitation, future studies would need to delay the administration of the recognition test in controls in order to equate for differences in memory strength that may cause interaction effects.

Previous studies showed that confabulation is associated with damage to the prefrontal lobes (Gilboa and Moscovitch, 2002). In particular, confabulating patients showed lesions to the ventromedial and orbitofrontal surfaces of the frontal lobes (Gliboa et al., 2006). The present study used patient's clinical MRI scans and found that the frontal lobes were more severely implicated in the confabulating group than the non-confabulating group, although this was sometimes relatively mild (see Appendix 3.1). These findings support the consensus that frontal lobe damage may be important in the development of confabulation than any other brain region (Turner et al., 2008).

In conclusion, non-confabulating patients and healthy controls showed a mood congruence bias and recalled more targets that matched the mood induced during the study phase. Although confabulating patients showed memory biases for unrelated intrusions, these patients did not show mood congruent or incongruent biases for target words. This indicated that mood in confabulation influences the content of their false memories but not true memories. The present study also indicated that negative mood in confabulating patients enhances the false recognition of pleasant memories. This positive emotional bias was not observed in non-confabulating patients and healthy controls. However, further analysis indicated that the positive bias in confabulating patients may be due to weak memory. A liberal response criterion may also have biased confabulating patients to mistake positive unrelated intrusions as previously studied.

Chapter Six

Discussion

This chapter will begin with a brief summary of the current programme of studies. In the later part of this chapter, the main findings will be discussed in terms of the underlying mechanisms impaired in confabulation.

6.1. Summary of present programme of studies

The present programme of studies showed the following novel insights in confabulating amnesia patients:

1) Confabulating patients showed a positive emotional bias in false recognition in response to an affective semantic-associates procedure where information was not encoded in a self-referent manner.

2) Confabulating patients did not show the positive emotional bias in response to encoding pictorial items in a facial expressions semantic-associates procedure.

3) Both confabulating and non-confabulating patients showed reduced false recognition of pictorial critical distracters.

4) Negative mood enhanced the positive emotional bias in confabulating patients' false recognition.

6.2. The Positive Emotional Bias in the Affective Semantic-Associates Procedure.

Fotopoulou and colleagues (2008b) examined whether confabulating patients' tendency to produce positive false memories is specific to self-referent information or due to a deficit in general emotional processing. They found that patients produced more pleasant confabulations in response to encoding self-referent prose (Fotopoulou et al., 2008b). This bias was not found when participants were asked to retrieve information that was not self-referent. The present study used an affective semantic-associates procedure and found that confabulating patients falsely recognised a higher proportion of positive unrelated intrusions compared with negative and neutral intrusions. Therefore confabulating patients showed a positive emotional bias in response to studying words that were not encoded in a self-referent manner.

However, the positive bias in confabulating patients was *only* observed in false recognition. No significant differences were found in terms of the proportion of positive unrelated intrusions falsely recalled between the confabulating patients, non-confabulating patients and healthy controls. Four possible explanations for these finding are discussed below:

One possible explanation relates to the distinction between provoked and spontaneous confabulations. False recognition in the semantic-associates procedure represents provoked confabulations. The recognition test comprises previously studied words and non-studied words presented to the participants in a display booklet. This test is a forced-choice task where false recognition is measured by asking participants to identify whether each presented word was previously studied. Therefore, the positive bias in false recognition may have been provoked as participants were presented with non-studied intrusions and asked to identify whether they were previously studied. In contrast, false recall in the semantic-associates procedure is more analogous to spontaneous confabulations. In the recall test, participants are required to access and retrieve the previously studied list without relying on any sense of familiarity. Therefore, this test examined the spontaneous production of critical distracters and unrelated intrusions.

Recognition memory involves two separate processes: recollection and familiarity. Recollection is the retrieval of information that was previously studied. Familiarity is a feeling that the information was previously studied. In the semantic-associates procedure, recollection occurs in both recall and recognition, whereas familiarity only occurs in recognition. Therefore, confabulating patients may have only shown a significant positive bias in false recognition because positive unrelated intrusions might have evoked a strong sense of familiarity.

Another possible explanation is proposed in relation to the delay between the recognition test and the study phase. Confabulating patients' may have falsely recognised a significantly high proportion of positive intrusions because they may have forgotten the studied list by the time the recognition test was administered. Confabulating patients may have not shown a significant bias in false recall because the recall test, as in the standard semantic-associates procedure, was administered immediately after the study phase. The current pattern of results supports this explanation. An observation of the figures in chapter 3 showed a trend in confabulating patients' false recall and false recognition. Confabulating patients produced a higher proportion of positive intrusions compared with non-confabulating patients and healthy controls in both false recall and false recognition. However, this bias did not reach a level of statistical significance in the recall test. It is postulated that a greater delay between the recall test and the study phase might have significantly increased the spontaneous production of positive intrusions.

Another explanation is proposed in relation to differences in memory strength. Findings from a signal detection analysis indicated that confabulating patients showed a positive bias because they have a weak memory *only* for positive information. This suggested that the positive bias is a consequence of weak memory rather than due to the impaired mechanisms in confabulation. In order to overcome this limitation, future studies would need to delay the administration of the recall and recognition tests in healthy controls. This delay would help equate memory performance of amnesic patients and healthy controls and prevent any interaction effects that might have resulted from the groups having different memory strengths. If future studies can show that there is no positive bias in delayed memory of non-confabulating patients and healthy controls, this would indicate that the positive bias is a consequence of impaired mechanisms in confabulation.

6.3. The Positive Emotional Bias in the Facial Expressions Semantic-Associates Procedure.

Several studies have consistently reported that items in the form of pictures are generally remembered better than words (Paivio & Csapo, 1973; Weldon & Roediger 1987). This was attributed to more distinctive qualities in pictures than in words. Schacter and colleagues (1997) used a pictorial semantic-associates procedure and found that the encoding of pictorial items reduced the overall rate of false recognition in healthy participants. Smith and Hunt (1998) obtained similar findings and showed that the distinct qualities in visual stimuli helped participants discriminate studied items from non-studied intrusions.

The present study used photographs of facial expressions to construct a pictorial semantic-associates task. In this study, confabulating patients did not show the positive emotional bias that was observed in study 1. The proportion of positive unrelated intrusions in the confabulating group was not significantly different from those in the non-confabulating group and healthy controls.

One possible explanation for these findings would be that the pictorial representations helped confabulating patients discriminate between studied items and positive unrelated intrusions. However, if this is the case, confabulating patients should show a reduced false recognition rate in response to studying pictorial items compared with studying written words. This was observed when the rate of false recognition was compared between the present study and study 1. Both confabulating and non-confabulating patients falsely recognised a significantly lower proportion of critical distracters and unrelated intrusions in this study compared with study 1. In relation to the mechanisms in amnesia, these findings suggested that pictorial information may enhance encoding and/ or retrieval processes, compared with verbal representations of the same or similar information.

However, one limitation is outlined in relation to the comparison between studies 1 and 2. The recognition test in the pictorial semantic-associates procedure is administered immediately after the study phase, whereas the recognition test in study 1 was administered at a delayed retention interval. Therefore, the proportion of intrusions and critical distracters may have been higher in study 1 because the delayed recognition test may have weakened memory. The reduced false recognition performance in study 2 might have been due to the recognition test following immediately rather than as a result of the pictorial stimuli.

However, the view that a delayed retention interval increased false recognition in study 1 compared with study 2 does not explain why healthy controls showed no significant differences in false recognition performance across the two studies. Therefore, another explanation is proposed in relation to Schacter's theory of gist memory. According to this theory, healthy participants falsely recognise critical distracters because they recall the gist of the list and fail to remember item-specific information (Schacter et al., 1996). Schacter and colleagues found that non-confabulating amnesic patients showed reduced false recognition of critical distracters compared with healthy controls. They argued that these patients retain limited gist information and form a weak link between the studied words.

Based on Schacter's gist theory (1996), healthy controls false recognition rate did not significantly decrease in study 2 because the non-presented items express facial emotions that are similar to the gist of the studied categories. For example, healthy participants are more likely to falsely recognise non-presented facial photographs that express anger in response to studying photographs from the anger emotional category. In contrast, confabulating and non-confabulating patients' have poor gist memory representations, which may have reduced their ability to form a link between the facial expressions in each category. Instead, these patients may have relied on the features or distinctive qualities in the pictures (such as the face, eyes, hair) rather than the emotion expressed. As a result, the confabulating and non-confabulating amnesia patients may have rejected more non-presented pictorial items because they did not have the distinctive characteristics associated with the studied items.

6.4. Reduced False Recall and False Recognition in Amnesia

Previous studies using the semantic-associates procedure showed that confabulating and non-confabulating amnesia patients falsely recalled and falsely recognised a lower proportion of critical distracters compared with healthy controls (Melo et al., 1999; Ciaramelli et al., 2006). This tendency to show reduced false recall and false recognition to critical distracters was attributed to poor gist representations in amnesia (Schacter et al., 1997).

Koutstaal and colleagues (2001) used a pictorial semantic-associates procedure to examine whether non-confabulating amnesia patients' reduced false recognition is due to degraded gist memory or a source memory deficit. They argued that a semantic-associates procedure that consists of pictures instead of words provides a clear measure of gist-based false recognition. This is because the conditions of conceptual and perceptual similarly provoke false recognition. Koustaal and colleagues found that non-confabulating patients falsely recognised a lower proportion of pictorial critical distracters compared with healthy controls. They concluded that amnesia patients have degraded gist memory that reduces the ability to form a link between the studied materials.

The present study showed that both confabulating and non-confabulating patients recognised a lower proportion of critical distracters compared with healthy controls. A signal detection analysis indicated that there were no significant differences between the groups on memory strength in terms of the proportion of critical distracters falsely recognised. These findings suggested that the reduced false recognition of critical distracters is a marker of gist memory impairment. The present findings provide a novel insight in indicating degraded gist memory in both confabulating and non-confabulating amnesia patients.

However, the results also showed that there were no differences between the confabulating and non-confabulating patients on the severity of their gist memory deficit as measured by the proportion of critical distracters falsely recognised. One possible explanation for this finding would be that degraded gist memory may be a consequence of an amnesic deficit rather than confabulation.

6.5. The Role of Mood on the Content of Confabulation

An association between mood and the positive emotional bias in confabulation has been reported in the literature (Fotopoulou et al., 2008a). However, previous findings on this topic have been inconsistent (Fotopoulou et al., 2008a; Metcalf et al., 2010; Bajo et al., 2010). The present study examined the role of mood in confabulation using video mood induction. Results showed that confabulating patients falsely recognised more positive intrusions in the negative mood condition compared with the positive mood condition. Furthermore, patients in whom a negative mood was induced falsely recognised a higher proportion of positive intrusions compared with non-confabulating patients and healthy controls. This indicated that negative mood enhances the positive bias in confabulating patients.

In the present study, confabulating patients in the positive mood condition also falsely recognised significantly more positive intrusions compared with healthy controls. This indicated that positive confabulations are enhanced, but are not specific to, negative mood states. In addition, negative mood significantly increased the overall rate of false recognition in confabulating patients compared with non-confabulating patients and healthy controls. This finding can be applied to explain the impaired mechanisms in confabulation. In relation to Fotopoulou's theory, one possibility would be that negative mood enhances emotional processing biases and increases the rate of confabulations by causing a further disruption to memory and executive processes.

The present study showed that negative mood significantly enhanced the positive bias in confabulating patients in false recognition. However, a similar but non-significant trend was observed in confabulating patients' false recall. As previously explained in study 1, the significant positive bias in false recognition but not in false recall might be due to delayed recognition testing. Negative mood might significantly increase false recall of positive intrusions if the recall test was delayed.

Findings from a signal detection analysis showed that the confabulating group had significantly lower memory strength in terms of the proportion of positive intrusions falsely recognised in the negative mood condition. This finding was not obtained in the negative and neutral word categories. This indicated that the positive bias in the negative mood condition may be due to weak memory in confabulating patients.

However, an explanation for why previous studies found a weak association between mood and the positive bias remains (Metcalf et al., 2010; Bajo et al., 2010). These studies examined the positive bias in clinically depressed confabulating patients. It is possible that they found a weak correlation because the patients may have not been experiencing low mood during the confabulation interview. Mood, particularly in patients with depression, is known to fluctuate from day-to-day. Self-report mood ratings taken one or two days before the confabulation interview may provide a less accurate measure of the effects of mood on the content of confabulation. In the present study, the effects of mood on confabulation may have been observed because the memory tests were administered immediately after mood induction.

Furthermore, mood congruent biases in memory have been found in response to the video mood induction procedures. This showed that non-confabulating patients and healthy controls correctly recalled and recognised more words that matched the mood induced at the time of learning the word lists. Interestingly, this finding was not observed in confabulating amnesia patients. Williams (1997) argued that memory biases occur when information is elaborately and deeply processed. In relation to the present findings, this suggested that confabulating patients may have a deficit in the processing of emotional material.

6.6. Conclusion

The current programme of studies used an affective semantic-associates procedure and provided a novel finding into the positive emotional bias in confabulation. Findings from these studies showed that the positive bias in confabulating patients is not specific to self-referent information. This study is also the first to show that the positive bias is not observed in confabulating patients when pictorial information is used to aid in the discrimination of studied items from non-studied intrusions.

The present findings of the positive bias in confabulating patients' false recognition are important because it shows that these patients are significantly more likely to mistake positive information as previously presented. This bias is significantly enhanced when the patient is in a negative mood. In relation to the mechanisms of confabulation, this suggested that due to emotional processing biases, confabulating patients have difficulties distinguishing true memories from positive intrusions.

However there are some limitations that have indicated that the semantic-associates procedure is not a good model of investigating the positive bias in confabulation. Firstly, confabulating patients may have *only* shown the positive bias in false recognition because the recognition test was administered at a delay. Although the confabulating patients showed a positive bias in terms of false recall of positive intrusions, this was not statistically significant. Delaying the recall test may enhance false recall of positive intrusions in confabulating patients.

Secondly, confabulating patients' tendency to falsely recognise a higher proportion of positive intrusions compared with non-confabulating patients and healthy controls may be due to an emotional processing bias. However, this may also be due to weak memory in confabulating patients. Significant group differences in memory strength were *only* found in the false recognition of positive intrusions. This undermines the observation that emotional factors may be involved in confabulation. If future studies delayed recall and recognition tests in controls and find the positive bias only in confabulating patients, this would have implications for confabulation and provide stronger evidence that emotional factors are playing a role in confabulation.

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Appendix 2.1: Advertisement email used to recruit healthy volunteers from King's College London for study 1, chapter 3.

TITLE: The Role of Emotions in Confabulation and Amnesia.

Volunteers are needed for a study of people with memory disorders. Your participation in this study is a maximum duration of 2 hours and you will be offered £30 for your contribution.

WHAT IS THIS STUDY ABOUT?

Confabulation is a memory symptom that is found in patients who experience brain damage to certain areas of the brain. Patients with this memory symptom tend to produce distorted or incorrect memories. This research study aims to investigate how emotions can influence the production of incorrect memories in patients with memory disorders. This study is part of a long-term project to help us understand whether emotions can trigger symptoms of confabulation.

WE ARE LOOKING TO RECRUIT VOLUNTEERS WHO ARE:

- Between 18 to 65 years of age, and have an adequate level of spoken and written English.
- No history of brain injury or mental health problems including depression.

WHAT WILL YOU NEED TO DO?

1) Your first task will be to complete neuropsychological tests that examine your reading, IQ, attention and concentration.
2) You will then be presented with words and pictures which you will be asked to remember in recall and recognition memory tests.

LOCATION:

The study will be run at the Institute of Psychiatry main building or one of the following NHS sites: South London and Maudsley NHS Foundation Trust, Kings College Hospital NHS Trust, Guys Hospital NHS Foundation Trust and St. Thomas' Hospital NHS Foundation Trust.

FURTHER INFORMATION:

Your participation is entirely voluntary. If you agree to take part and later wish to withdraw, you may do so at any time. All information will be treated anonymously and will be strictly confidential. More information is available on the participant information sheet available to all potential participants. If you are interested in participating or would like further information, please send an email to the research psychologist at nura.alkathiri@kcl.ac.uk (Division of Psychological Medicine and Psychiatry).

Thank you for considering taking part and taking the time to read this information.

Appendix 2.2: Advertisement email used to recruit healthy volunteers from King's College London for study 3, chapter 5.

TITLE: The role of emotions in confabulation and amnesia.

Healthy control participants are needed for a study of people with memory disorders or confabulation. Your participation in this study is a maximum duration of 2 ½ hours. You will be offered £20 as a contribution towards your time, effort and travel expenses.

WHAT IS THIS STUDY ABOUT?

Confabulation is a memory symptom that is found in patients who experience brain damage to certain areas of the brain. Patients with this memory symptom tend to produce distorted or incorrect memories. This research study aims to investigate how emotions can influence the production of incorrect memories in patients with confabulation and memory disorders. This study is part of a long-term project to help us understand whether emotions can trigger symptoms of confabulation.

WE ARE LOOKING TO RECRUIT VOLUNTEERS WHO ARE:

- Between 18 to 65 years of age, and have an adequate level of English.
- No history of brain injury or mental health problems including depression.

WHAT WILL YOU NEED TO DO?

1) You first task will be to complete cognitive paper and pencil tasks.
2) Session 1 - You will then be presented with a short video clip. Following this is a simple memory task, where you will be presented with words which you will be asked to remember in recall and recognition memory tests. Once you have completed this, you will be contacted after

approximately two weeks and asked to come back and complete session 2.

3) Session 2 - You will be presented with another short video clip. You will then be presented with words which you will be asked to remember in recall and recognition memory tests.

<u>If you decide to take part in this research, please note that it is important that you attend both session 1 and session 2.</u>

LOCATION:

The study will be run at the Institute of Psychiatry main building or one of the following NHS sites: South London and Maudsley NHS Foundation Trust, Kings College Hospital NHS Trust and Guys and St. Thomas' Hospital NHS Foundation Trust.

FURTHER INFORMATION:

Your participation is entirely voluntary. If you agree to take part and later wish to withdraw, you may do so at any time without giving a reason. All information obtained will be treated anonymously and will be strictly confidential. More information concerning participation is available on the participant information sheet available to all potential participants. If you are interested in participating or would like further information, please send an e-mail to the researcher at nura.alkathiri@kcl.ac.uk.

Thank you for considering taking part and taking the time to read this information.

Appendix 2.3: An adapted UK version of the Dalla Barba Confabulation Battery used to allocate participants to the confabulating and non-confabulating amnesia groups.

Dalla Barba's confabulation battery

From Mike Kopelman: personal communication (cited in his Kopelman, Ng & Van den Brouke (97) paper))

Code:
Date:

(?)=Examiner's request for clarification or detail
DK=don't know
boldface=confabulation
italics=correct information

A) PERSONAL SEMANTIC MEMORY:

1. What is your name?
2. How old are you?
3. What is your date of birth?
4. Where were you born?
5. When were you admitted to the hospital?
6. What is your present address?
7. Why are you in hospital?
8. Are you married?
9. Do you have any children?
10. How many children do you have?

11. How old are your children?
12. How old were you when you had your first child?
13. What are your children's first names?
14. What are your children's birth dates?
15. Are your parents alive?
16. What are your parents' first names?
17. What was your father's job?
18. Do you have any brothers or sisters?
19. What are your brothers' first names?
20. Have you seen me before?

B) EPISODIC MEMORY:

1. What did you eat for dinner yesterday?
2. What did you do yesterday?
3. Who did you meet this morning?
4. How did you spend last Christmas?
5. What did you do for your last birthday?

6. Do you remember the last time you went to see a doctor?	
7. Do you remember the last time you went to the cinema?	
8. Do you remember the last time you went to the restaurant?	
9. Do you remember the day of your admission to this hospital?	
10. What were you doing the day Princess Diana was killed? (31.8.97)	
11. Do you remember your first day at junior school?	
12. Do you remember your first child's birth?	
13. Do you remember your wedding? (or a wedding you attended)	
14. Do you remember your last day at school?	
15. Do you remember when you were admitted to the hospital for the first time?	

C) Orientation in Time and Place:

1.	What year are we?
2.	What season are we?
3.	What month are we?
4.	What is the date?
5.	What day of the week are we?
6.	What time is it?
7.	What city are we in?
8.	Where are we now?
9.	In which country are we now?
10.	On which floor are we located?

D) General Semantic Memory:

1.	When did World War I start?
2.	When did World War II start?
3.	What happened to President Kennedy?
4.	Who is Montgomery?
5.	Who is Dennis Compton? (cricketer)
6.	Who is George Best (footballer)?
7.	Who is Winston Churchill?

8. Who is Marilyn Monroe?	
9. Who is the Prime Minister?	
10. What happened in Kuwait in 1989?	
11. What happened to Robert Maxwell?	
12. What happened to the Pope recently?	
13. What happened to Princess Grace of Monaco?	
14. What happened in Northern Ireland in 1969?	
15. What happened in the Falklands?	

E) I DON'T KNOW – SEMANTIC:

1. Who won the football championship/league in 1982?	
2. Who won the Nobel Prize for literature in 1980?	
3. Who won gold medal in the men's Epée competition for the last two Olympics?	
4. Who was Foreign Secretary in 1965?	
5. Who is president of Mexico?	
6. How many Renault cars were sold in 1985?	
7. Which team is world champion in fencing?	
8. Which state abolished the	

	monarchy in 1973?
9.	In what form of employment was Marilyn Monroe’s father?
10.	Who arrived in London in April 1982?

F) I DON’T KNOW – EPISODIC:

1.	What did you do 13th March 1985?
2.	What colour was the tie of the doctor who examined you last time?
3.	What did you do Christmas day 1957?
4.	What did you do on your 25th birthday?
5.	What were you doing last month?
6.	What were you doing last year?
7.	On your last visit to the bank, what was the clerk wearing?
8.	What did your school teacher say the first time you saw her?
9.	When you last took the bus, how was the person next to you dressed?
10.	On Tuesday of last week, what did you eat for supper?

Appendix 2.4: Negative, positive and neutral studied word lists, critical distracters and unrelated intrusions from the semantic-associated procedure used in study 1, chapter 3.

Negative Studied Lists	
Critical Distracter	Item
	Mad
	Fear
	Hate
	Rage
	Temper
	Fury
Anger	Ire
	Wrath
	Happy
	Fight
	Hatred
	Mean
	Calm
	Emotion
	Enrage
	Garbage
	Waste
	Can
	Refuse
	Sewage
	Bag
	Junk
	Rubbish
Trash	Weep
	Scraps
	Pile
	Dump
	Landfill
	Debris
	Litter
	Bad
	Shooter
	Worry
	Danger
	Sorrow
	Fear
	School

Positive Studied Lists	
Critical Lure	Item
	Want
	Dream
	Desire
	Hope
	Well
Wish	Think
	Star
	Bone
	Ring
	Wash
	Thought
	Get
	True
	For
	Money
	Sour
	Candy
	Sugar
	Bitter
	Good
	Taste
	Tooth
	Nice
Sweet	Honey
	Soda
	Chocolate
	Heart
	Cake
	Tart
	Pie
	Ugly
	Pretty
	Girls
	Women
	Homely
	Lovely
	Nice

Neutral Studied Lists	
Critical Lure	Item
	Table
	Sit
	Legs
	Seat
	Couch
Chair	Desk
	Recliner
	Sofa
	Wood
	Cushion
	Swivel
	Stool
	Sitting
	Rocking
	Bench
	Pencil
	Write
	Fountain
	Leak
	Quill
	Felt
	BIC
	Scurrile
Pen	Crayon
	Cross
	Tip
	Marker
	Red
	Cap
	Letter
	Hot
	Heat
	Pipe
	Cook
	Warm
	Fire
Stove	Oven

Trouble	Problem Police Fight Sad **Difficulty** Help Maker **Jail**

Beautiful	Picture Lady Mountain Snow **Scene** Music Day **Gorgeous**

	Wood Kitchen Lid Coal **Gas** Iron Range **Furnace**

Positive Unrelated Intrusions			
Peace	Truth	Sing	Summer
Friend	Fair	Fragrance	Handsome
Right	tender	pride	Strong

Negative Unrelated Intrusions			
Steal	Hurt	War	Harsh
Death	Fright	Crime	Cold
Crook	Sickness	Funeral	Burglar

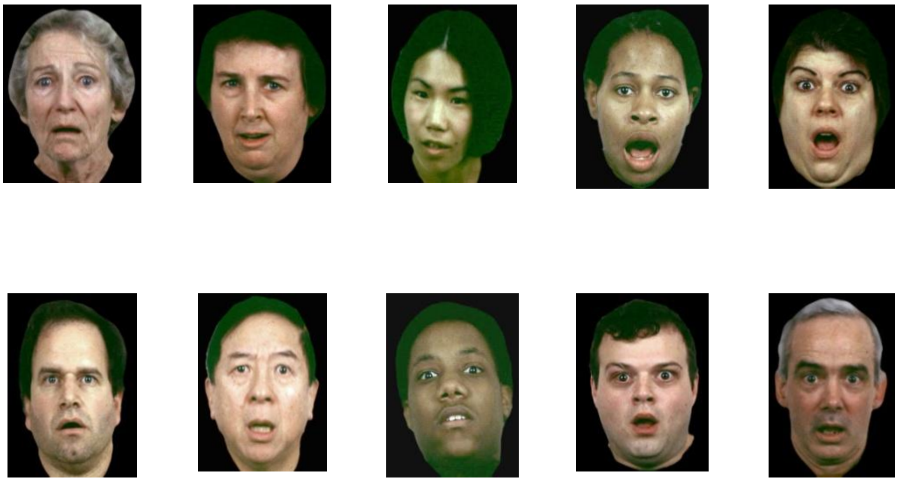
Neutral Unrelated Intrusions			
Door	Radio	Ball	Road
House	Apple	Time	Bulb
Dog	River	Sky	Pendant

Appendix 2.5: Facial expressions of the six emotional categories (anger, disgust, fear, happy, neutral and sad) from the facial expressions semantic-associates procedure used in study 2, chapters 4.

Anger Emotional category	
Critical Distracter	Ten studied photographs of anger facial expressions
	

Disgust Emotional Category	
Critical Distracter	Ten studied photographs of disgust facial expressions
	

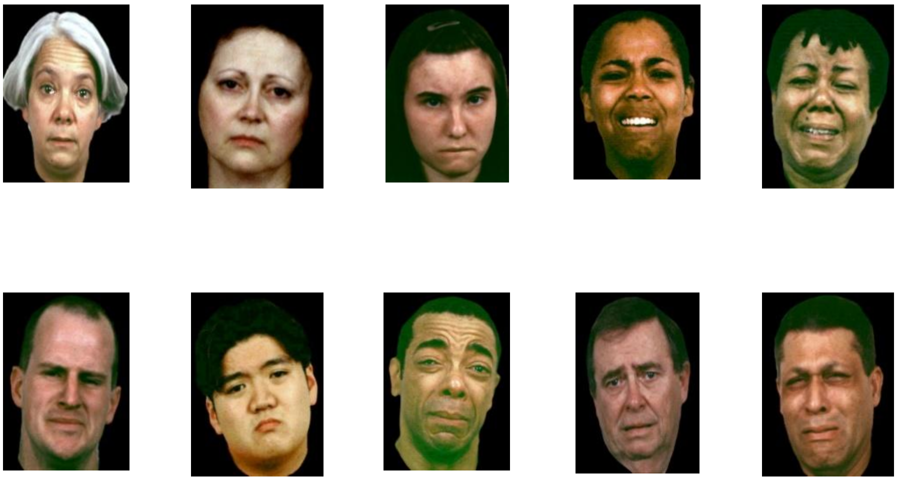
Appendix 2.5 (continued)

Fear Emotional Category	
Critical Distracter	Ten studied photographs of fear facial expressions
	

Happy Emotional Category	
Critical Distracter	Ten studied photographs of happy facial expressions
	

Appendix 2.5 (continued)

Neutral Emotional Category	
Critical Distracter	Ten studied photographs of neutral facial expressions
	

Sad Emotional Category	
Critical Distracter	Ten studied photographs of sad facial expressions
	

Appendix 2.5 (continued)

Anger Emotional Category: Unrelated Intrusions

Disgust Emotional Category: Unrelated Intrusions

Fear Emotional Category: Unrelated Intrusions

Happy Emotional Category: Unrelated Intrusions

Appendix 2.5 (continued)

Neutral Emotional Category: Unrelated Intrusions

Sad Emotional Category: Unrelated Intrusions

Appendix 2.6: Pilot Study data obtained for each of the eight high intensity photographs within the six emotional categories (anger, disgust, fear, happy, neutral and sad). The photograph that received the highest rating within each category was used as the critical distracter.

Table 6.1: Eight high intensity photographs from the anger emotional category.

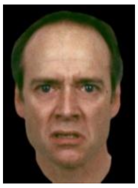
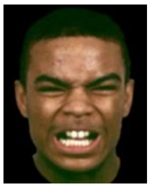
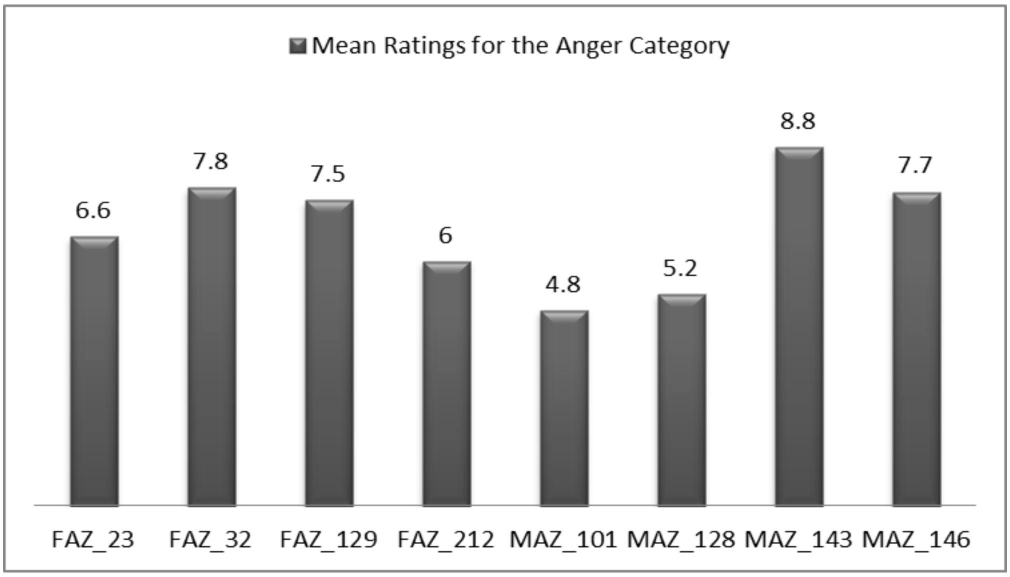
 FAZ_23	 FAZ_32	 FAZ_129	 FAZ_212
 MAZ_101	 MAZ_128	 MAZ_143	 MAZ_146

Figure 6.1: Mean Ratings of Each Photographs for Expressing Anger



Appendix 2.6 (continued)

Table 6.2: Eight high intensity photographs from the disgust emotional category.

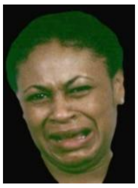
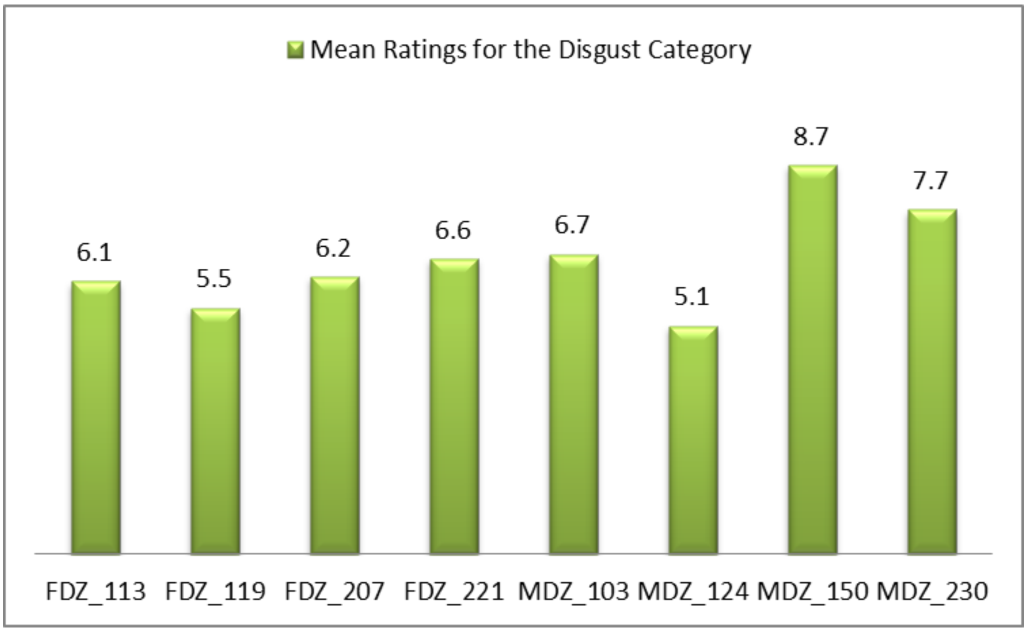
			
FDZ_113	FDZ_119	FDZ_207	FDZ_221
			
MDZ_103	MDZ_124	MDZ_150	MDZ_230

Figure 6.2: Mean Ratings of Each Photographs for Expressing Disgust

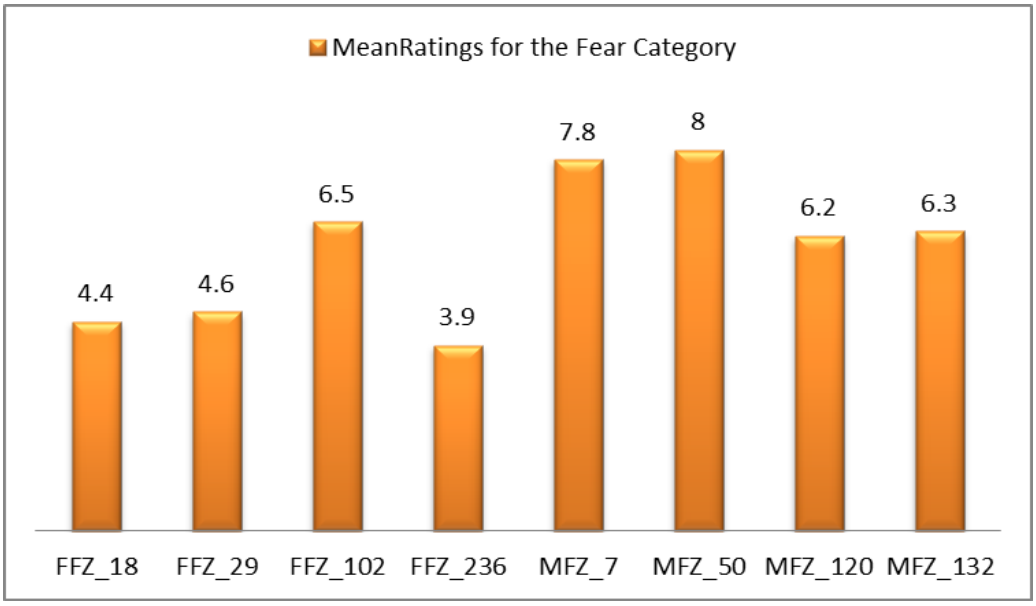


Appendix 2.6 (continued)

Table 6.3: Eight high intensity photographs from the fear emotional category.

			
FFZ_18	FFZ_29	FFZ_102	FFZ_236
			
MFZ_7	MFZ_50	MFZ_120	MFZ_132

Figure 6.3: Mean Ratings of Each Photographs for Expressing Fear



Appendix 2.6 (continued)

Table 6.4: Eight high intensity photographs from the happy emotional category.

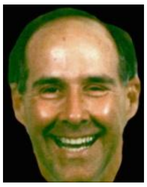
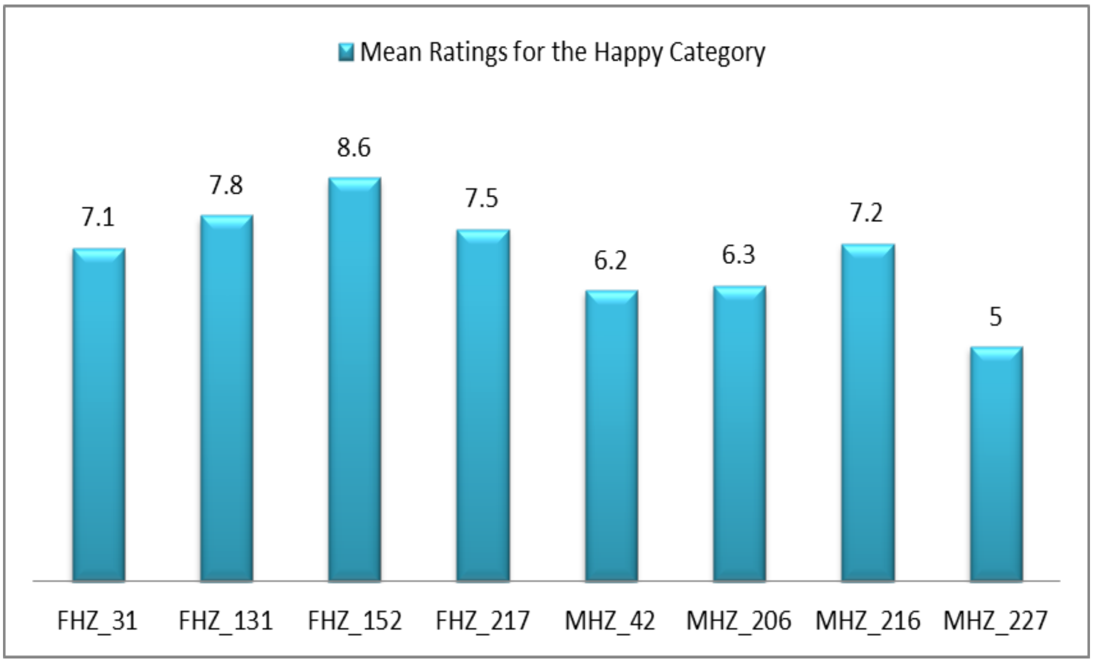
			
FHZ_31	FHZ_131	FHZ_152	FHS_217
			
MHZ_42	MHZ_206	MHZ_216	MHZ_227

Figure 6.4: Mean Ratings of Each Photographs for Displaying a Happy Emotional Expression

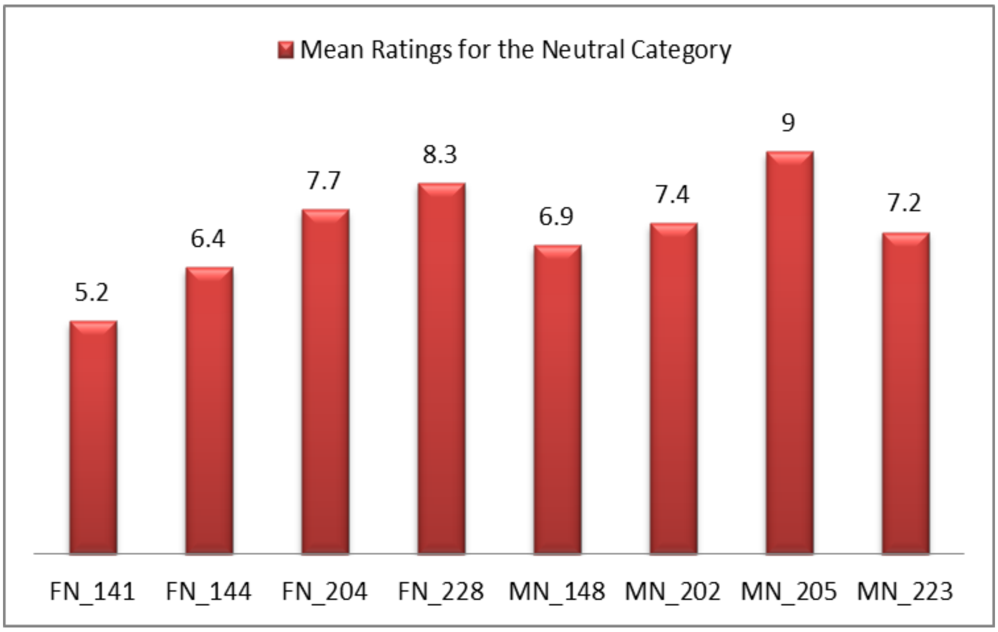


Appendix 2.6 (continued)

Table 6.5: Eight high intensity photographs from the neutral emotional category.

			
FN_141	FN_144	FN_204	FN_228
			
MN_148	MN_202	MN_205	MN_223

Figure 6.5: Mean Ratings of Each Photographs for Displaying Neutral Facial Expression

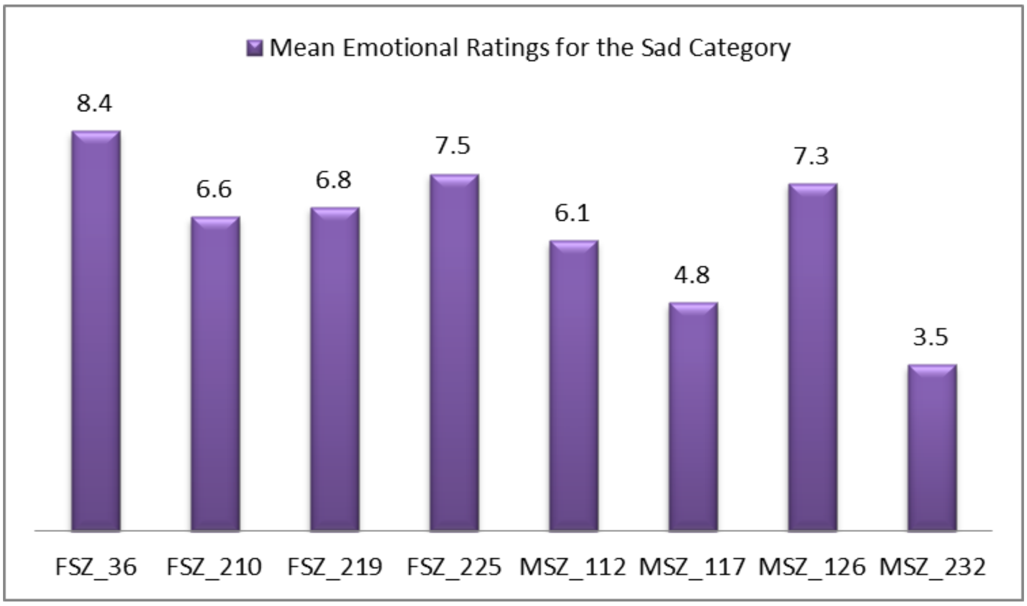


Appendix 6.6 (continued)

Table 6.6: Eight high intensity photographs from the sad emotional category.

			
FSZ_36	FSZ_210	FSZ_219	FSZ_225
			
MSZ_112	MSZ_117	MSZ_126	MSZ_232

Figure 6.6: Mean Ratings of Each Photographs for Displaying Sad Facial Expression



Appendix 2.7: Positive Affective Negative Affect Scale (PANAS) questionnaire used after the mood induction procedure for study 3, chapter 5.

PANAS Questionnaire

This scale consists of a number of words and phrases that describe different feelings and emotions. Read each item and then mark the appropriate answer in the space next to that word. Indicate to what extent you feel this way right now, that is, at the present moment.

1	2	3	4	5
Very slightly	a little	moderately	quite a bit	extremely

_______ Cheerful	_______ Disgusted	________Pleased
_______Irritable	_______ Bubbly	________ Glad
_______ Sad	_______ Afraid	________ Distressed
_______Shaky	_______ Happy	________ Amused
_______Upset	_______ Angry	
_______ Fantastic	_______ Guilty	
_______Joyful	_______ Elated	
_______Hostile	_______ Lively	
_______Ashamed	_______ Scared	
_______Enthusiastic	_______ Delighted	
_______Loathing	_______ Smiling	

Appendix 2.8: Pilot Study data used to examine whether the positive and negative video clips used for study 3 induce the target mood states.

Table 6.7 shows mean mood ratings on the positive and negative scales in the PANAS questionnaire after the administration of the positive video clip.

	Positive Mood Condition		
	Positive Mood Rating	Negative Mood Rating	t- value, df (3)
Mean (SD)	35.4 (5.3)	14.8 (1.3)	$t(3)=8.55$, $p<.01$

Table 6.8 shows mean mood ratings on the positive and negative scales in the PANAS questionnaire after the administration of the negative video clip.

	Negative Mood Condition		
	Positive Mood Rating	Negative Mood Rating	t- value, df (3)
Mean (SD)	17.0 (2.6)	28.0 (4.2)	$t(3)=3.74$, $p<.05$

Appendix 2.9: Negative, positive and neutral studied lists, critical distracters and unrelated intrusions from for the semantic-associated procedure used in study 3, chapter 5.

Negative Lists	
Critical Distracter	Item
Anger	**Mad**
	Fear
	Hate
	Rage
	Temper
	Fury
	Ire
	Wrath
	Happy
	Fight
	Hatred
	Mean
	Calm
	Emotion
	Enrage
Trash	**Garbage**
	Waste
	Can
	Refuse
	Sewage
	Bag
	Junk
	Rubbish
	Weep
	Scraps
	Pile
	Dump
	Landfill
	Debris
	Litter
Trouble	**Bad**
	Shooter
	Worry
	Danger
	Sorrow
	Fear
	School
	Problem
	Police
	Fight
	Sad
	Difficulty
	Help
	Maker

Positive Lists	
Critical Lure	Item
Wish	**Want**
	Dream
	Desire
	Hope
	Well
	Think
	Star
	Bone
	Ring
	Wash
	Thought
	Get
	True
	For
	Money
Sweet	**Sour**
	Candy
	Sugar
	Bitter
	Good
	Taste
	Tooth
	Nice
	Honey
	Soda
	Chocolate
	Heart
	Cake
	Tart
	Pie
Beautiful	**Ugly**
	Pretty
	Girls
	Women
	Homely
	Lovely
	Nice
	Picture
	Lady
	Mountain
	Snow
	Scene
	Music
	Day

Neutral Lists	
Critical Lure	Item
Chair	**Table**
	Sit
	Legs
	Seat
	Couch
	Desk
	Recliner
	Sofa
	Wood
	Cushion
	Swivel
	Stool
	Sitting
	Rocking
	Bench
Pen	**Pencil**
	Write
	Fountain
	Leak
	Quill
	Felt
	BIC
	Scurrile
	Crayon
	Cross
	Tip
	Marker
	Red
	Cap
	Letter
Stove	**Hot**
	Heat
	Pipe
	Cook
	Warm
	Fire
	Oven
	Wood
	Kitchen
	Lid
	Coal
	Gas
	Iron
	Range

	Jail
Thief	**Steal** **Robber** Crook Burglar Money Cop Bad Rob Jail Gun Villain **Crime** Bank Bandit **Criminal**

	Gorgeous
Justice	**Peace** **Law** Court Judge Right Liberty Government Jury Truth Blind Fair **Supreme** Crime Department **Trial**

	Furnace
Window	**Door** **Glass** Pane Shade Ledge Sill House Open Curtain Frame View **Breeze** Sash Screen **Shutter**

Condition 1: Positive Unrelated Intrusions			
Flower	Tender	Song	Cure
Friend	Pride	Wealth	Summer

Condition 2: Positive Unrelated Intrusions			
Strong	Roses	Cute	Handsome
Fragrance	Cozy	Freedom	Rest

Condition 1: Negative Unrelated Intrusions			
Death	Hurt	War	Harsh
Fright	Funeral	Sickness	Cold

Condition 2: Negative Unrelated Intrusions			
Grief	Pain	Poison	Stink
Evil	Bite	Tired	Burn

Condition 1: Neutral Unrelated Intrusions			
Walk	Collar	Ball	Road
Apple	River	Time	Bulb

Condition 2: Neutral Unrelated Intrusions			
Sky	Pendant	Button	Bowl
Floor	Town	Office	Radio

Appendix 3.0: Confabulating and non-confabulating patients' clinical MRI reports by a Neuroradiologist and Professor Michael Kopelman.

Confabulating Group				
Participant ID	Age	Pathology	Report by Neuroradiologist	Additional Comments by Neuropsychiatrist Professor Michael Kopelman
H3003M	68	1) Traumatic Brain Injury. 2) Heavy Alcohol misuse.	There is a large occipital infarct and cerebellar atrophy consistent with heavy alcohol misuse. 2012 MRI shows greater degree of cortical atrophy. There was also frontal grey matter thinning, ventricular enlargement.	Nil
Q8899D	40	Korsakoff Syndrome	There are numerous scattered periventricular / deep white matter T2 hyper-intense foci in both cerebral hemispheres. There was also patchy signal change in keeping with minor small vessel ischemic change.	Professor Kopelman added that there was a minor degree of medial temporal lobe atrophy in this patients MRI scan.
V5979K	67	Korsakoff Syndrome	Atrophy associated with signal alteration	Professor Kopelman added that the

			in the right thalamus and white matter small vessel disease.	lateral ventricles were enlarged. There was also sulcal widening and sylvian fissures were also enlarged.
E8858D	55	Korsakoff Syndrome	Atrophy in frontal and the cerebellum regions consistent with alcohol misuse.	Nil
Y7974B	67	Korsakoff Syndrome	Prominence of the ventricles and sulci. High signal on T2/FLAIR within the subcortical white matter of both cerebral hemispheres.	Professor Kopelman added that there was bilateral hippocampal atrophy. There was also a minor degree of small vessel change.
D8818B	61	1) Cerebrovascular Disease. 2) History of Alcohol Misuse.	Minor degree of cerebellar atrophy. He has small vessel disease and a thalamic infarct suggestive of continued misuse of alcohol.	Nil
P4433P	62	1) Cerebrovascular Disease. 2) TIA	There was small areas of damage within the left cerebral hemisphere (middle artery territory). Minor degree of frontal lobe atrophy.	Professor Kopelman added that there was small vessel disease in the frontal region.
P8722N	53	HIV with Frontal Lobe Syndrome	Cerebral atrophy, frontal small vessel disease and frontal	Nil

			cortical atrophy. Frontal lobe periventricular white matter.	
S8848O	56	Temporal Lobe Epilepsy	MRI shows bilateral scierosis related to seizures.	Professor Kopelman added that there was a mild degree if cortical atrophy with sylvian fissure widening, bilaterally.
X975OL	45	Systemic Lupus Erythematosus	MRI shows minimal prominence of cortical sulci, but no significant vascular disease.	Professor Kopelman added that the atrophy particularly involved the frontal lobes.

Appendix 3.0 (continued)

Non-confabulating Group				
Participant ID	Age	Pathology	Report by Neuroradiologist	Additional Comments by Neuropsychiatrist Professor Michael Kopelman
H0352M	50	Korsakoff Syndrome	There is a mild prominence of the ventricles. There was a focal area of T2 hyper-intensity within the central pons.	Minor atrophy in the posterior cortical regions and small vessel change.
O8389K	59	1) Traumatic Head Injury. 2) Chronic Alcohol abuse.	There was a large volume area of encephalomalacia in the left temporal lobe with some dilatation of the left occipital horn. There is some haemosiderin straining suggestive of haemorrhagic components. This distribution is more in keeping with previous trauma. There is also small vessel disease.	Nil
Z5866T	57	1) HIV in the context of PCP.	There is generalised prominence of the	Nil

		2) Harmful use of Alcohol.	ventricles. There is minor patchy T2 high signal change within the corona radiata bilaterally. A solitary punctate focus of increased susceptibility within the white matter of the left cerebellar hemisphere.	
C1288E	46	1) Chronic Alcohol abuse. 2) Small Vessel Disease.	There is a T2 focus in the left paramedian pons, which demonstrates free diffusion. A few scattered subcortical T2 hyper-intense foci in both cerebral hemispheres are likely to be on a mall vessel ischaemic basis.	Nil
Y3834B	38	1) HIV 2) Hepatitis C 3) History of Substance Abuse (Cocaine)	There is mild prominence of cortical sulci.	Professor Kopelman added that there was atrophy in the right hippocampal region.
N8282B	68	Korsakoff Syndrome	There are a couple of non-specific foci in the left external capsule and right thalamus.	Nil

M5353Y	65	1) Cerebrovascular Disease. 2) Chronic Alcohol Abuse.	Extensive confluent small vessel ischemic change.	Professor Kopelman added that there is preiventricular white matter small vessel disease, particularly involving the basal ganglia and internal capsules bilaterally. The left parieto occipital region was also involved. There was also a minor degree of generalised atrophy.

Appendix 3.1: The location of brain atrophy in the confabulating group and the degree of a frontal lobe involvement.

Site of Brain Atrophy	Number of Patients	Most severe frontal involvement	Moderate frontal involvement	Minor frontal involvement
Frontal Lobe Atrophy	5	MRI reports from five confabulating patients indicated frontal lobe atrophy. Participants ID: H3303M, E8858D, P4433P, P8722N, X9750L.		
Thalamic Change	2		An MRI report from two confabulating patients confirmed thalamic changes, likely to involve frontal projections. Participants ID: V5979K, D8818B.	
Generalised Cortical Atrophy	2		An MRI report from one confabulating	An MRI report from one confabulating

			patient indicated a moderate degree of generalised atrophy involving the frontal lobes. This also included bilateral hippocampal atrophy. Participant ID: Y7974B.	patient indicated generalised atrophy that involved a mild degree of generalised cortical atrophy with sylvian fissure widening, and mild involvement of the frontal lobes. Participant ID: S8848O.
Small Vessel Disease	1			An MRI scan of one patient indicated small vessel disease, i.e. mild involvement of the frontal lobes. Participant ID: Q8899D.

Appendix 3.1 (continued): The location of brain atrophy in the non-confabulating group and the degree of a frontal lobe involvement.

Site of Brain Atrophy	Number of Patients	Most severe frontal involvement	Moderate frontal involvement	Minor frontal involvement
Posterior Atrophy	1			An MRI report from one non-confabulating patient showed minor atrophy in the posterior region, i.e. mild frontal involvement. Participant ID: H0352M.
Thalamic Change	1		An MRI report from one patient showed thalamic changes, likely to involve the frontal lobes. Participant ID: N8282B.	
Generalised Cortical Atrophy	5		An MRI report from one non-confabulating patient showed moderate degree of generalised atrophy	MRI reports from four non-confabulating patients showed generalised atrophy involving the

			involving the frontal lobes. This included atrophy in the right hippocampal region. Participant ID: Y3834B.	frontal lobes, i.e. mild involvement of the frontal lobes. Participant ID: Z5866T, C1288E, M5353Y, O8389K.